

Chapter 3.0 Affected Environment

3.1 Introduction

This chapter describes the affected environment associated with the Proposed Action and alternatives for the Toquop Land Disposal amendment to the Caliente MFP and the Toquop Energy Project. The affected environment discussions describe existing conditions for those resources comprising the physical, biological, cultural, and human and socioeconomic environments within the project area. Maps 2-1, 2-2, and 2-3 in Chapter 2 depict the project area for the Proposed Action and Alternative 3, Alternative 1, and Alternative 2, respectively. These project areas include the Toquop and Pah Rah land parcels and adjacent lands in the Toquop area for which the BLM would process a land exchange and/or issue ROWs for the construction, operation, and maintenance of the proposed project. The Toquop and Pah Rah areas, as well as the project areas and project features for the Proposed Action, Alternative 1, Alternative 2, and Alternative 3 are described in detail in *Chapter 2, Sections 2.1 through 2.5*.

3.2 Soils and Geology

3.2.1 Soils

This section describes the soils of the three land parcels being evaluated, the alternative water pipeline alignments, the natural gas pipeline and transmission line alignment, the wellfield, and the access roads to the two alternative power plant sites. The U.S. Natural Resources Conservation Service (NRCS) (1965, 1979, 1990) provides more detailed information on soils.

3.2.1.1 Toquop Area

3.2.1.1.1 Proposed Action. The Proposed Action power plant site and water pipeline corridor (southern Toquop parcel, western water pipeline alignment) cover four soil associations: the Aymate-Canutio, Mormon Mesa, St. Thomas-Zeheme-Rock Outcrop, and the Zeheme Rock Outcrop associations (NRCS, 1990). The proportion of the four associations varies according to project area location. The Aymate-Canutio association consists of well-drained soils ranging from very gravelly loamy sand to gravelly sandy loam with a slight slope of 2 to 4 percent. The soils are highly susceptible to wind erosion and moderately susceptible to water erosion, factors that may have a bearing on reclamation potential. The Mormon Mesa association consists of well-drained soils ranging from fine sandy loam to gravelly fine sandy loam, primarily with a very slight slope of zero to 2 percent. The soils are highly susceptible to wind erosion and slightly susceptible to water erosion. The St. Thomas-Zeheme-Rock outcrop association consists of predominantly well-drained soils ranging from very gravelly sandy loam to very gravelly fine sandy loam, and some unweathered bedrock. Slopes are steep, varying from 20 to 50 percent. The loams are generally moderately susceptible to both wind and water erosion. The Zeheme-Rock outcrop association consists of extremely stony fine sandy loam (well-drained) and unweathered bedrock with steep slopes from 30 to 50 percent. The loam is slightly susceptible to both wind erosion and water erosion.

The access road would cross four soil map units. These are: the Mormon Mesa fine sandy loam with zero to 8 percent slopes; the Flattop gravelly clay loam with 2 to 8 percent slopes; the Rock Land-St. Thomas cobbly loam association with slopes from 15 to 60 percent; and the Badland unit of stratified sand, silt, and clay with slopes from 15 to 50 percent. These units are generally well-drained, except for the Badland where runoff is very rapid, and the wind and water erosion potential varies from slight to very high.

A mosaic of 25 soil associations are distributed across the proposed wellfield in the Tule Desert. The soils are predominantly gravelly sandy loam to very gravelly sandy loam in texture, with some cobble-dominated soils and very fine to fine sandy loam soils. Slope varies from zero to 75 percent with many of the associations falling within the zero to 15 percent or 30 to 50 percent ranges. All associations are well-drained, with the exception of associations having the Arizo soil series which is excessively drained. The majority of the associations are only slightly wind erodible, with a few being very slightly erodible to not erodible by wind. The Geta soil series in the Geta-Arizo association is extremely wind erodible. The majority of the soil associations in the proposed wellfield area are not highly susceptible to water erosion.

Biological soil crusts are present at the proposed power plant site and along the proposed water pipeline corridor. No biological soil crusts appear to be located in the wellfield. These soil crusts serve to reduce the rate of water and wind erosion that could occur in their absence.

3.2.1.1.2 Alternative 1. The power plant site and water pipeline corridor for Alternative 1 (southern Toquop parcel,

eastern water pipeline alignment) occur on four soil associations. Three of these are the same as described for the Proposed Action: the Aymate-Canutio, Mormon Mesa, and St. Thomas-Zeheme-Rock outcrop associations. The fourth association, the Bracken gravelly fine sandy loam with 2 to 8 percent slopes, is considered to be somewhat excessively drained. This association is highly susceptible to wind erosion and moderately susceptible to water erosion.

The access road would cross the same soil map units described for the Proposed Action. Biological soil crusts are present along the proposed water pipeline corridor and the proposed power plant site.

3.2.1.1.3 Alternative 2. The power plant site and utility corridor for Alternative 2 (northern Toquop parcel, eastern gas pipeline/transmission line alignment) occur on the same four soil associations as Alternative 1. These are the Aymate-Canutio, Mormon Mesa, and St. Thomas-Zeheme-Rock outcrop associations, and the Bracken gravelly fine sandy loam with 2 to 8 percent slopes (NRCS, 1990).

The access road would cross the same soil map units described for the Proposed Action south of the southern Toquop parcel and the same soil map units described for the pipeline/transmission line utility corridor north of the southern Toquop parcel. Biological soil crusts are present along the utility corridor and may also occur at the northern power plant site.

3.2.1.1.4 Alternative 3. The sites for the power plant, water pipeline corridor, access road, and wellfield for Alternative 3 (air-cooled power plant, southern Toquop parcel, western water pipeline alignment) are the same as were described for the Proposed Action. The descriptions of soils

for Alternative 3 are the same as those presented in *Section 3.2.1.1.1, Proposed Action*.

3.2.1.2 Pah Rah Parcel

The Pah Rah exchange parcel consists of the Oppio-Rezave-Rock outcrop association, the Osobb-Rezave-Fireball association, and the Bombadil-Hefed-Rubble land association (NRCS, 1979). The Oppio-Rezave-Rock outcrop association is the primary soil association on the Pah Rah parcel. It consists of extremely stony very fine sandy loam and rock outcrop. It is well-drained and occurs on slopes up to 15 percent. The hazard of wind erosion is slight. The Osobb-Rezave-Fireball association is found on the southern portion of the Pah Rah parcel. It consists of extremely stony fine to very fine sandy loam, with slopes up to 50 percent. The hazard of water erosion is slight to high, and the hazard of wind erosion is slight. The Bombadil-Hefed-Rubble land association is found on the northern portion of the Pah Rah parcel. It consists primarily of very stony sandy loam with slopes between 10 and 70 percent. The hazard of water erosion is high, and the hazard of wind erosion is slight.

3.2.2 Geology

3.2.2.1 Toquop Area

This section provides context for the subsequent evaluation of potential project-induced environmental consequences to the local geologic resources in the project area. Geologic features and issues related to seismicity are also discussed in this section. Additional geologic-related information is presented in *Section 3.4, Ground Water Resources*, as context for

evaluating the potential impacts to ground water resources.

3.2.2.1.1 Regional Geologic History and Setting.

The project area is located within the Basin and Range physiographic province, which covers much of interior western North America (see Map 3-1). The Basin and Range Province owes its descriptive name to the general geologic history common to this part of the country that has given rise to the present-day landscape of alternating generally north-south trending mountains separated by intervening valleys or basins.

Although the current landscape formed only during the past 10 to 20 million years, the geologic history of the region is much longer with important features dating to the Precambrian Era (more than 550 million years before present [Ma]). Igneous and metamorphic rocks of Precambrian age are the oldest and lowest unit in the regional stratigraphic column and are therefore commonly referred to as “basement.” Early Cambrian age formations principally consisting of quartzite and shale are also typically considered basement primarily because of their relatively impermeable nature with respect to ground water flow (see *Section 3.4, Ground Water Resources*).

Throughout much of the Paleozoic Era, beginning in the early Cambrian time (around 500 Ma) and continuing into the Permian Period (approximately 250 Ma), present-day eastern and southern Nevada formed the continental shelf off of what was then the west coast of North America (the ancient shoreline ran through present-day western Utah). This shallow marine environment gave rise to the deposition of massive sequences of carbonate rocks (such as limestone and dolomites) that accumulated to thicknesses of as much as

30,000 feet. The area that formed the ancient continental shelf stretched from present-day southern Idaho, across eastern Nevada to southeastern California. The resulting carbonate deposits are exposed in many mountain ranges, and form a thick wedge, generally thinning eastward, that constitutes an extensive regional feature commonly referred to as the carbonate-rock province. The thickness and lithology (composition) of the Paleozoic carbonate rocks are notable in their homogeneity over large areas in the province. The carbonate-rock province is discussed further in *Section 3.4, Ground Water Resources*, with respect to ground water resources.

The Permian Period (between 240 and 290 Ma) generally marked the end of the environment that produced the thick deposits of carbonate rock, and by the middle Triassic (approximately 220 Ma) the continental margin had shifted westward so that present-day eastern Nevada was an area of continental deposition. Rocks of middle Triassic to Early Jurassic age in eastern Nevada, therefore, largely consist of sandstone, shale, and freshwater limestone.

It was also during the late Mesozoic that the Sevier orogeny (period of mountain building) occurred that coincided with extensive regional compression of the earth's crust generally along the same belt that formed the ancient continental shelf during Paleozoic time (from southern Idaho through western Utah and southeastern Nevada and California). This period of crustal compression resulted in extensive folding and thrust faulting in which older (Paleozoic) rocks were pushed up and over younger (Mesozoic) rocks. In some cases, folding and thrust faulting resulted in doubling or tripling the total thickness of the Paleozoic carbonate rocks.

The geologic structure of the region became even more complex in the middle late Tertiary (starting around 20 Ma) when the tectonic forces reversed, resulting in crustal extension (stretching). The entire region underlying present-day eastern Nevada was essentially pulled apart by tensional forces. Large-scale normal (vertical offset) faulting caused huge blocks to be dropped, tilted, or rotated in response to being pulled apart or thinned. In addition to extensive normal faulting, nearly vertical strike-slip (lateral offset) faulting and widespread volcanism also occurred during middle and late Tertiary times. The overall result of the east-west extensional tectonics was that north-south oriented mountain ranges were raised and tilted, and basins formed in the intervening depressed areas. Erosion of the mountain ranges and the subsequent deposition of the erosional debris filled the valleys with several hundred to several thousand feet of sediment. The resulting parallel sequence of mountain ranges and intervening basins combine to give the region its characteristic basin-range topography seen today.

3.2.2.1.2 Local Geology. Expressions of the aforementioned geologic history are exposed locally within and around the project area (see Map 3-2). The plant site under the Proposed Action is located on the northern flank of the lower Virgin River Valley, between the East Mormon Mountains to the west and the Tule Springs Hills to the north and northeast. Structurally, the lower Virgin River Valley consists of a deep tectonic basin referred to as the Virgin River Depression. With a depth of up to 6 miles, the Virgin River Depression is one of the deepest basins in the Basin and Range Province (Langenheim et al., 2001).

Map 3-1 (8-1/2 x 11; color) page 1 of 2

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Map 3-2 (11 x 17; color) page 1 of 2

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The substrate at the plant site consists of alluvial material composed of the erosional debris from the surrounding uplifted areas. Much of the basin-fill deposits in the lower Virgin River Valley north of the Virgin River, including in the vicinity of the proposed plant site, consist of the Muddy Creek Formation. Outcrops of this formation just west of Mesquite have been described by Kowallis and Everett (1986) to be poorly sorted coarse to fine-grained sand and sandstone with siltstone and mudstone. At the plant site, under the Proposed Action, ephemeral washes have cut into the alluvium exposing firmly cemented gravel conglomerate, at least 5 feet thick, within a few feet below the surface. The lateral extent of this calcium-carbonate cemented material is unknown, but is likely to be widespread in the vicinity of the plant site. This conglomerate layer is very hard and will likely require blasting to remove if excavation is required during construction. The need for blasting will depend on results of geotechnical investigations during final design.

Under the Proposed Action and Alternative 3, the utility corridor passes through the Toquop Gap, which separates the East Mormon Mountains on the south from the Tule Springs Hills to the north. For Alternatives 1 and 2, the utility corridor passes directly through the Tule Springs Hills, which are prime examples of the extreme structural complexity that characterizes basin and range geology. The utility corridor for these alternatives follows the existing dirt road that snakes through a small topographic gap produced by massive local thrust faulting just south of Jumbled Mountain whose descriptive name portrays the complex local geology of the Tule Springs Hills.

The wellfield and the plant site under Alternative 2 lie within the Tule Desert, which is described in more detail in *Section 3.4, Ground Water Resources*. The near-surface substrate (up to approximately 1,000 feet deep) in the Tule Desert consists of unconsolidated to semi-consolidated alluvial basin-fill deposits, which were deposited as erosional debris from the surrounding uplifted areas. Based on test drilling within the wellfield area, the Tule Desert basin-fill deposits consist of principally unconsolidated coarse sands and gravel with some silt and clay within the uppermost 100 to 200 feet, but thereafter rapidly progress into a thick (greater than 500 feet) sequence of silts, clays, and sands. At depths of at least 600 feet, the proportion of coarse-grained sediments (silty sands and gravel) increases. Unlike at the plant site for the Proposed Action, no conglomerate or caliche (calcium carbonate) layers have been observed. Based on the local test drilling, the depth to consolidated rock is on the order of 1,000 feet.

3.2.2.1.3 Geologic Faults and Seismicity. The complex geologic history of the project area and its vicinity has resulted in numerous geologic faults along which both significant vertical and lateral offset has occurred in the distant past. Despite the extensive local faulting, however, few significant active faults occur in the vicinity of the project area.

The nearest, most significant, active faults are associated with the Piedmont fault zone. This fault zone, which cuts Pleistocene terrace deposits, runs along the northern base of the Virgin Mountains and extends along the western base of the Beaver Dam Mountains, approximately 20 miles south and east of the plant site for the Proposed Action.

Other mapped and named but inactive faults in the project area include the following:

- The Gourd Spring fault, which runs along the eastern base of the East Mormon Mountains
- The East Tule Desert fault, which parallels the Gourd Spring Fault along the west side of both the East Mormon Mountains and the Tule Springs Hills
- The Tule Corral fault, which runs north-south through the southern Tule Springs Hills
- The East Tule Springs Hills fault, which cuts through the southern Tule Springs Hills and parallels the Tule Corral Fault approximately 10 miles to the east

In the vicinity of the plant site under the Proposed Action, numerous small unnamed vertical-offset faults have displaced Muddy Creek and younger (Quaternary age—less than 1.7 Ma) alluvial deposits. The local washes at the plant site (discussed in *Section 3.3, Surface Water Hydrology*) are thought to follow the trace of some of these faults, which are fairly evenly spaced (a few hundred to over 1,000 feet apart) and trend between north and north-northwest. Although these local small offsets are potentially active (having experienced movement in recent geologic time), any future displacement is not anticipated to result in a significant earthquake.

The current level of earthquake potential in southern Nevada is relatively low compared to more active parts of the Basin and Range Province (von Seggern and Brune, 2000). No major earthquakes (greater than a magnitude of 6.0) have

been recorded within approximately 50 miles of the project area since at least 1868. A magnitude 6.1 quake did occur in 1966 near Caliente, however, approximately 62 miles north of the project area. Seismicity in southern Nevada is dominated by small earthquakes of less than magnitude 4.0, and these events have generally been associated with either the area around the Nevada Test Site (which suggests that those events are from past underground nuclear testing), or around Lake Mead. Small earthquakes near Lake Mead are thought to be related to stress imposed by the filling of the lake (Von Seggern and Brune, 2000).

Earthquake hazard maps developed by the U.S. Geological Survey (USGS) for southern Nevada indicate very low earthquake potential and associated ground acceleration in the vicinity of the project area.

3.2.2.2 Pah Rah Parcel

3.2.2.2.1 Local Geology. Situated near the western margin of the Basin and Range Province, the Pah Rah parcel is essentially the top of a mesa and its surrounding flanks, situated on the southeastern slope of the Pah Rah Mountains, in Washoe County, Nevada. The Pah Rah Mountains are volcanic, and the mesa on the parcel is primarily composed of Tertiary volcanic rocks consisting of basalt and andesite flows that range in age from 6 to 14 Ma, and volcanic rocks of the Pyramid Sequence, which are also primarily basalt of similar age (Green et al., 1991).

3.2.2.2.2 Geologic Faults and Seismicity. The geologic map of the Reno Quadrangle (Green et al., 1991), where the parcel is located, indicates that the Pah Rah Mountains contain numerous

vertical displacement faults that are primarily oriented to the northeast. One such fault runs along the northwestern and northern edge of the parcel, along the northern flank of the mesa. The age and active status of this specific fault are unknown. In addition to the numerous faults within the Pah Rah Mountains, the Truckee River Valley, approximately 5 miles north and east of the parcel, appears to be fault controlled.

Earthquake hazard maps developed by the USGS for Nevada indicate that the potential for ground movement is moderately high in the vicinity of the Pah Rah parcel, but the associated level of ground acceleration is likely to be moderate.

3.3 Surface Water Hydrology

3.3.1 Toquop Area

This section provides context for the subsequent evaluation of potential project-induced environmental consequences to the surface water resources in the project area. Additional hydrologic information is presented in *Section 3.4, Ground Water Resources*.

3.3.1.1 Hydrologic Setting

The project area, which includes the Proposed Action, as well as Alternatives 1, 2, and 3, is located within the Tule Desert and the Virgin River Valley hydrographic areas of the Colorado River Basin (see Map 3-3). All surface water within these areas ultimately flows toward the Colorado River (Lake Mead) via the Virgin River.

3.3.1.2 Local Climate

The arid climate of the project area reflects the desert environment that characterizes much of southeastern Nevada (see the discussion of local climate as it pertains to air resources in *Section 3.6.1.1.1, Climate and Meteorology*). In the higher elevations surrounding the project area the climatic regime transitions from arid to sub-alpine. Table 3-1 summarizes relevant statistics on climatic conditions representative of the project area and surrounding vicinity.

The project area is subject to extreme temperature variations between summer daytime highs, which can exceed 100°F for weeks at a time, and winter nighttime lows, which typically dip well below freezing during December and January.

Of particular importance to the surface water hydrology, however, is the amount and pattern of precipitation. On the local valley floors, and on the lower elevations of the surrounding mountains and hills, the average annual precipitation is significantly less than 10 inches per year (see Table 3-1). This precipitation falls as rain, typically during two different seasons. The greatest amount usually falls during the winter (January to March) as regional cold fronts from the west produce relatively long duration, but low intensity rainfall events. Precipitation is also likely to occur during the summer (July to September) as a result of generally localized, short duration, high intensity convectional storms (thunderstorms fueled by rising warm air masses).

TABLE 3-1
Summary of Climatic Statistics in the Vicinity of the Project Area

Location	Elevation (feet above mean sea level)	Average Annual Total Precipitation (inches)	Maximum Average Monthly Precipitation and Minimum Average Monthly Precipitation (inches)	Maximum Average Monthly Temperature and Minimum Average Monthly Temperature (° F)
Beaver Dam, Nevada ¹ Period of Record: 8/1/1956- 12/31/2000	1,900	7.8	1.03 (March) 0.18 (June)	105.6 (July) 31.6 (December)
Mesquite, Nevada ¹ Period of Record: 1943-46, 1954-60, 1963	1,600	6.1	No record	No record
Bunkerville, Nevada ¹ Period of Record: 12/1/1979-12/31/2000	1,550	6.3	1.03 (January) 0.17 (May and June)	105.5 (July) 28.9 (December)
Elgin, Nevada (SE) ¹ Period of Record: 5/1/1965- 6/30/1985	3,300	16.8	2.52 (March) 0.14 (June and July)	100.1 (July) 30.7 (December and January)
Elgin, Nevada ¹ Period of Record: 3/1/1951- 12/31/2000	3,400	14.0	2.21 (February) 0.42 (June)	97.9 (July) 27.7 (December)
Carp, Nevada ² Period of Record: 1950, 1952-54, 1956, 1962	2,625	4.0	No record	No record

Sources:

¹Western U.S. Climate Historical Summaries, Western Regional Climate Center, Desert Research Institute, Division of Atmospheric Sciences.

²Glancy and Van Denburgh (1969)

With increasing elevation in the mountains that surround the project area, the amount of precipitation generally increases. Areas above 4,000 feet have annual precipitation totals that likely exceed 10 inches (Walker, 2002). Within the watershed of the Tule Desert, the Clover Mountains reach elevations of almost 7,000 feet. The corresponding precipitation amounts in these areas are estimated to average between roughly 13 and 16 inches per year (Walker, 2002).

Surface evaporation rates run counter to local precipitation amounts, and are relatively high. On the local valley floors, the average annual surface evaporation is considerably higher than the average annual rainfall primarily because the generally high air temperatures and the typically low relative humidity in the arid valleys. On the floor of the Virgin River Valley, for example, the annual evaporation rate has been reported by

Map 3-3, color, 8-1/2 x 11, page 1 of 2

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Woessner, et al. (1981), to be approximately 80 inches, or roughly 27 times the average annual precipitation at a similar location.

3.3.1.3 Surface Water Features

3.3.1.3.1 Virgin River. The principal surface water feature in the vicinity of the project area is the Virgin River, which flows southwesterly approximately 13 miles south of the project area (see Map 3-4). The Virgin River originates in Utah near Zion National Park and, upon exiting a gorge through the Beaver Dam Mountains (“the Narrows”), the river flows through the lower Virgin River Valley on its way toward the Overton Arm of Lake Mead on the Colorado River.

The flow in the river is quite variable both seasonally and annually, and differences in the reported values are largely a function of the particular period of record that corresponds to the reported value. The most consistently reported value of the average annual flow is approximately 177,000 acre-feet per year (afy), at Littlefield, Arizona, roughly 9 miles upstream of Mesquite, Nevada (Dixon and Katzer, 2002). A similar value of 174,000 afy for the average annual flow at Littlefield has been reported by Metcalf (1995); and Black and Rascona (1991). However, average annual flows as low as 162,200 acre-feet per year (Glancy and Van Denburgh, 1969) and as high as 193,300 acre-feet per year (Holmes et al., 1997) have been reported at the same location.

Seasonal flows in the river generally reflect the prevailing climatic conditions with peak flows corresponding to the local winter rainy season, the effects of which are typically prolonged by periods of spring snowmelt in the upper portions of the river basin. As a result, approximately

50 percent of the annual flow typically occurs between February and May (Woessner et al., 1981). Despite the tendency for locally intense summer thunderstorms, flows are generally low during the summer.

The principal components to the flow of the Virgin River in the vicinity of the project area include: 1) flow from upstream; 2) inflow from local tributaries; 3) direct precipitation; and 4) irrigation return flow (residual water applied to crops in the river flood plain that infiltrates the soil and subsequently discharges to the river). At Littlefield, Arizona, upstream of the project area, discharge from a series of springs is also an important component of flow in the Virgin River. These springs are discussed further in *Section 3.4, Ground Water Resources*.

Within the lower Virgin River Valley, the only perennial tributary of the Virgin River is the Beaver Dam Wash (Map 3-4), which joins the Virgin River just upstream of Littlefield. Although the Beaver Dam Wash is perennial along several reaches, little or no surface flow actually occurs at the confluence with the Virgin River most of the year. Estimated annual discharge rates for this wash are highly variable, but the long-term (1970 to 1994) annual average is roughly 12.5 cubic feet per second (cfs) or 9,000 acre-feet per year (Holmes et al., 1997).

All other tributaries to the Virgin River within the lower Virgin River Valley are ephemeral washes, which only flow for short periods in response to significant rainfall events. In the vicinity of the project area, the washes capture surface runoff from the Tule Springs Hills, the Tule

Desert, and the Mormon and East Mormon mountains, and flow generally southward

toward the river. Although approximately six named washes in the vicinity of the project area drain into the Virgin River (see Map 3-4), the Toquop Wash and its tributaries, discussed below, are the most important within the project area.

As it proceeds toward Lake Mead, flow in the Virgin River decreases as a result of:

- 1) consumptive use (through irrigation and other agricultural water demands);
- 2) evapotranspiration (the combined effect of direct evaporation and transpiration by natural vegetation along the river); and
- 3) infiltration into the local ground water system (Glancy and Van Denburgh 1969; Woessner et al. 1981; Black and Rascona 1991).

Specifically, portions of the Virgin River are diverted for irrigation at Mesquite, Bunkerville, and Riverside. These three diversions are estimated to reduce the river flow collectively by approximately 20 percent or 38,000 acre-feet per year (Woessner et al., 1981). Historically, this has meant that some of the time all of the available water has been diverted during periods of low flow (June through August).

These diversions, together with evapotranspiration and infiltration, cause the river to lose flow as it makes its way toward Lake Mead because essentially no water enters the river downstream of the Beaver Dam Wash and the Littlefield springs, apart from seasonal inflows from the ephemeral washes such as Toquop, and return flows from excess irrigation water. Specific studies on the interaction between ground water and the Virgin River have concluded that, between Littlefield and its confluence with Lake Mead, the river basically is

“losing” flow (water from the river infiltrates the subsurface and recharges ground water, as opposed to a “gaining” river, which receives inflow from ground water) (Glancy and Van Denburgh, 1969; Woessner et al., 1981; Metcalf, 1995; Las Vegas Valley Water District, 1992). Further discussion on the ground water/surface water interaction in the Virgin River Valley is presented in *Section 3.4, Ground Water Resources*, and CH2M HILL (2002b).

Compared with the average flow at Littlefield (177,000 acre-feet per year, see above), the Virgin River at its mouth in the Overton Arm of Lake Mead was estimated to be approximately 80,000 acre-feet per year by Glancy and Van Denburgh (1969). They further report that, very little, if any, of this Virgin River flow reaches Lake Mead during the summer. Actual reported data at the mouth of the river, however, are limited. A single measurement of flow of approximately 24 cubic feet per second (cfs) was reported by Metcalf (1995) in October 1992. In addition, an average value of flow of 138,420 acre-feet per year was reported by Woessner et al. (1981), based only on data from June 1980 to May 1981. This value of flow is approximately 86 percent of the value of flow at Littlefield over the same period.

3.3.1.3.2 Tule Desert and Toquop

Wash. The proposed plant site under Alternative 2, and the wellfield under all project alternatives, are within the Tule Desert hydrographic area (Map 3-4). All surface drainage from the Tule Desert, and ultimately from all other portions of the project area, is carried by the Toquop Wash, which flows south-southeast to the Virgin River.

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Within the Tule Desert, numerous small unnamed washes direct localized surface runoff into progressively larger tributaries of the Toquop Wash. Two of the larger tributaries of the Toquop Wash within the Tule Desert are Garden and Sam's Camp washes, which both originate at the base of the Clover Mountains (see Map 3-4).

As with all of the other tributaries to the Virgin River below Littlefield, the Toquop Wash is ephemeral and flows only for short durations as a result of significant precipitation events. Although flow of the Toquop Wash has not been directly quantified, it has been estimated by Glancy and Van Denburgh (1969) to contribute an average of approximately 1,400 acre-feet per year to the Virgin River.

3.3.1.3.3 Local Springs. Several small springs are located in the mountains and hills that surround the project area. The discharge from these springs, however, does not contribute to surface flows in the Toquop Wash or any of its tributaries. The discharge from these springs typically is very low (all are less than 1 gallon per minute [gpm] and most are less than half that rate), and if not captured for stock water, either evaporates directly or soaks into the ground where it subsequently evaporates or is lost through transpiration by plants. Similarly, these springs do not contribute to flows in the Virgin River. Further identification and discussion of these springs is presented relative to ground water resources in *Section 3.4, Ground Water Resources*.

3.3.1.3.4 Proposed Action Plant Site. Six small, parallel, unnamed washes, spaced approximately 1,000 feet apart, direct surface runoff southeast toward a larger unnamed tributary wash, which

joins the Toquop Wash approximately 1 mile southeast of the plant site.

Approximately 1 mile north of the plant site, the South Fork Toquop Wash joins the Toquop Wash (see Map 3-4). The South Fork is the largest tributary of the Toquop Wash, and drains much of the eastern Mormon Mountains and the northern East Mormon Mountains.

3.3.1.4 Relevant Floodplain Delineation

The entire project area is located within a Zone D Floodplain, as defined by the Federal Emergency Management Agency (FEMA) floodplain maps. Zone D floodplains are defined as "areas of undetermined, but possible, flood hazards" (Map Index Community Panel Number 3200140001-5525). As a result, no portion of the plant site under the proposed action is actually within a specified floodplain.

3.3.1.5 Water Quality

The Virgin River is generally characterized by high concentrations of total dissolved solids (TDS) on the order of 1,000 to 3,000 milligrams per liter (mg/L) (Glancy and Van Denburgh 1969; Woessner et al 1981). Composed mainly of calcium, sodium, sulfate, and chloride, the concentration of TDS shows a strong inverse correlation with the flow of the river. Concentrations of TDS are most dilute when flows are the highest, and tend to increase during periods of low flow. During low-flow periods, the flow in the river is dominated by discharges from springs with high TDS concentrations and irrigation return flows, which also tend to concentrate salts. In addition, because the quantity of irrigation return flows increases with distance downstream along reaches where irrigated agriculture is

present, the concentration of TDS has similarly been shown to increase with distance downstream for the same reaches (Glancy and Van Denburgh, 1969; Woessner et al., 1981). Specifically, a 30 percent increase (between 2,000 mg/L and 2,700 mg/L) in TDS concentration between Littlefield and Riverside was reported by Glancy and Van Denburgh (1969).

In addition to dissolved minerals, the Virgin River carries a large quantity of suspended solids that gives it its characteristic muddy appearance. The material in suspension is largely silt- and clay-sized particles, while the transported material along the river bed is largely sand-size. The average annual quantity of suspended material passing by Littlefield is reported to be 2.7 million tons, with the minimum reported value being less than 1 million tons and the maximum value over 6 million tons (Glancy and Van Denburgh, 1969).

3.3.2 Pah Rah Parcel

The climate of Washoe County, where the Pah Rah parcel is located, is mild with low humidity and rainfall and characterized as semi-arid to arid. Although the Pah Rah parcel is located within the Truckee River Basin, there are no surface water features at or near the parcel including any significant ephemeral drainages or springs. The Truckee River, which flows west to east before turning north and terminating at Pyramid Lake, is approximately 1.5 miles north of the parcel and is not connected to the parcel.

3.4 Ground Water Resources

This section provides context for the evaluation of potential project-induced

environmental consequences to the local ground water resources in the project area. The ground water environment, both regional and local to the project area, is directly linked to the geological conditions described in *Section 3.2, Soils and Geology*. The relationship between ground water and surface flows in the Virgin River is also discussed in this section as it relates to potential project-induced impacts. A separate technical report on the regional and local hydrogeology, the *Water Resources Technical Report* (CH2M HILL, 2002b) has been prepared. The report provides more detailed discussion and analysis of many of the ground water related topics presented in this EIS.

3.4.1 Regional Conditions

3.4.1.1 Setting

The project area is located within the Tule Desert and Virgin River Valley hydrographic areas (see Map 3-5), within the Basin and Range physiographic province (see *Section 3.2, Soils and Geology*).

The Tule Desert is the location of the wellfield in the Proposed Action. Elongated in a generally north-northeast direction, the Tule Desert is a singular topographic basin that is surrounded by the Clover Mountains to the north and northwest, the Tule Springs Hills to the east, and the East Mormon and Mormon mountains to the south and southwest, respectively. Covering an area of approximately 125,000 acres, the Tule Desert is approximately 32 miles long and 12 miles across. The floor of the Tule Desert slopes from all directions toward the Toquop Gap, which separates the East

Map 3-5 (11 x 17; color) page 1 of 2

Map 3-5 (11 x 17; color) page 2 of 2

Mormon Mountains from the Tule Springs Hills. The Toquop Gap forms the only natural hydrologic outlet from the Tule Desert, and it is through this low-lying area that the Toquop Wash drains ephemeral surface water runoff from the Tule Desert (see *Section 3.3, Surface Water Hydrology*).

The plant site under the Proposed Action is located within the Virgin River Valley, which abuts the Tule Desert to the north and similarly forms a singular topographic basin in which all surface water drainage is toward the Virgin River and Lake Mead. Technically, the Virgin River Valley extends from the Tule Desert east to the Beaver Dam Mountains in Utah and south to the Virgin Mountains in Arizona. Geologically, much of the Virgin River Valley sits above a deep tectonic basin in which the underlying bedrock is as much as 6 miles below the valley floor (see *Section 3.2, Soils and Geology*).

3.4.1.2 Ground Water Occurrence

3.4.1.2.1 Basin and Range Province.

Within the Basin and Range Province, ground water occurs in both the sediments that have filled the valleys to their current elevations (basin-fill deposits) and the underlying rock that also comprises the surrounding hills and mountains. In the Tule Desert and Virgin River Valley, ground water is, therefore, stored and conveyed through two principal aquifer systems: 1) saturated, poorly consolidated basin-fill deposits, consisting mainly of silty and clayey sands with occasional clay and gravel layers, locally represented by the Muddy Creek Formation (see *Section 3.2, Soils and Geology*); and 2) the underlying fractured sedimentary (for example, limestone, dolomite) or volcanic rocks.

In the Basin and Range Province, some basin-fill aquifer systems are localized and relatively shallow. Ground water in these deposits generally flows in directions that coincide with decreasing ground-surface elevations (that is, “downhill”). Ground water can flow between hydrographic areas, or basins, where the basin-fill deposits from adjacent areas merge, such as at the Toquop Gap where the basin-fill deposits of the Tule Desert are continuous with those of the Virgin River Valley.

The underlying fractured-rock aquifer systems, on the other hand, are regional features in which ground water flows irrespective of the local topography and hydrographic-area boundaries. Ground water in the deep fractured-rock systems flows in response to regionally controlled hydraulic gradients driven by regional recharge and discharge areas, and is generally not significantly influenced by conditions in the overlying basin-fill aquifer systems. In addition, although individual rock formations are laterally discontinuous and typically highly deformed structurally, the basic rock types are essentially continuous and transcend the boundaries of the hydrographic areas. As a result, it is very difficult, if not impossible, to place lateral bounds around the fractured-rock aquifer systems. Further discussion on the basic principles of flow through fractured rock is presented in CH2M HILL (2002b).

3.4.1.2.2 Carbonate-Rock Province.

As described in *Section 3.2, Soils and Geology*, a substantial portion (approximately 200 million years) of the geologic history of this part of the Basin and Range Province involved the deposition of massive sequences of carbonate rocks (limestone and dolomite) over a wide area of present-day eastern Nevada, western Utah, and the

northwestern tip of Arizona. Because such a large area has this common geologic past as much as 50,000 square miles in Nevada alone, this portion of the Basin and Range Province is also commonly referred to as the carbonate-rock province (Mifflin and Hess, 1979; Dettinger et al, 1995; Prudic et al., 1995).

Inasmuch as the carbonate-rock province is a descriptive term primarily used by hydrogeologists, its definition also includes a reference to ground water. Specifically, Dettinger et al. (1995) describe the carbonate-rock province as, "...that part of the Basin and Range Province in which ground water flow is predominately or strongly influenced by carbonate-rock aquifers of Paleozoic age."

According to Dettinger et al. (1995, Figure 1) and Plume (1996, Figure 2), the Tule Desert and Virgin River Valley hydrographic areas are located just within the southeastern edge of the carbonate-rock province. However, as discussed in *Section 3.4.2, Local Conditions*, Paleozoic carbonate rocks, while they comprise a significant portion of the local mountains and hills that rim the Tule Desert, do not necessarily comprise the shallowest fractured-rock aquifer formations within the Tule Desert and Virgin River Valley hydrographic areas.

Dominated by limestones and dolomites, the carbonate rocks in this region are brittle and subject to fracturing, and under the right geochemical conditions can dissolve and form cavities that further enhance the ability of these rocks to store and transmit ground water. The large geographic area underlain by these carbonate rocks, together with their demonstrated capacity to transmit large volumes of ground water, is evidence that the carbonate rocks of Nevada comprise

aquifer systems of regional scale and significance (Dettinger et al., 1995).

Because of their significance, the aquifer systems of the carbonate-rock province have been studied extensively on a regional scale by the U.S. Geological Survey (USGS) (Harrill and Prudic, 1998). Computer models of the regional carbonate aquifer systems developed by the USGS indicate that the total volume of ground water that flows through these aquifers over the entire carbonate rock province is about 1.5 million acre-feet per year (afy), based on fairly sparse data. Specifically, within the Nevada portion of the Colorado River Basin, the flow through the carbonate aquifer is estimated by the USGS to be more than 200,000 afy. These estimates are based on very general assumptions for conditions in the Tule Desert and Virgin River Valley for which there were no available data on the carbonate rock aquifer system in these areas at the time of those analyses.

3.4.2 Local Conditions

3.4.2.1 Tule Desert Hydrogeology

General descriptions and inferences on the hydrogeologic conditions of the Tule Desert area are found in the published literature dating back to the early 20th century (for example, Carpenter [1915]). Until recently, however, very little specific data were available because the ground water resources of the Tule Desert have been only minimally developed.

As part of the investigation of the feasibility of using ground water from the Tule Desert for the proposed power plant alternatives, several monitoring wells (MW-1 through MW-5) and one pilot production well (PW-1) have been installed, sampled, and tested in the area of

the proposed wellfield (see Map 3-5). MW-1 and MW-2 consist of nested wells (one well screened in the basin fill [shallow] and one well screened in the fractured rock [deep]) within a common borehole. MW-3 and MW-4 are individual monitoring wells screened in the fractured rock, and MW-5 is screened in the basin fill. Much of the information presented in this section comes from that fieldwork, the details of which are presented in CH2M HILL (2002b).

3.4.2.1.1 Ground Water in the Basin-Fill. Based on the logs of boreholes drilled in the wellfield area, the basin-fill in the Tule Desert consists of older alluvium of probable Pleistocene age (approximately 10,000 to 1.7 million years old [Ma], and perhaps Pliocene age [approximately 1.7 to 5 Ma]), that was deposited as erosional debris from the surrounding up-faulted areas (see *Section 3.2, Soils and Geology*). Although these deposits consist principally of unconsolidated coarse sands and gravel with some silt and clay within the uppermost 100 to 200 feet, they typically transition rapidly thereafter to a massive sequence dominated by either silty or clayey sands that is 300 or more feet thick. In some locations, layers of coarse-grained sediments (silty sands and gravel) and layers of clay occur at depths of 600 feet or more (CH2M HILL, 2002b).

In addition, the available data suggest that although a general pattern to the layering is discernable, discrete layers within the basin-fill deposits are laterally discontinuous. Consequently, although the lower portions of the basin-fill are saturated, a single continuous aquifer unit is difficult to identify. In addition, ground water is likely to be locally perched (that is, it occurs as laterally discontinuous pockets of saturated sediments that are

independent of a specific basin-fill aquifer).

Further evidence of the complexity of the ground water conditions within the basin-fill deposits comes from the available ground water-level data. In addition to revealing that the depth to ground water in the basin-fill is generally very deep, the water-level data also confirm the likelihood of more than one ground water-containing zone within these deposits (for example, perched ground water). Specifically, the available data reveal depths to ground water (as of February 2002) of approximately 390 feet (Tule Well), 496 feet (MW-2 [shallow]), and 718 feet (MW-5).

Results from geophysical studies reported in Langenheim et al. (2001) indicate that the thickness of the basin-fill deposits generally increases toward the center of the Tule Desert. The results in Langenheim et al. (2001), however, also suggest that the top of the fractured rock is highly irregular with localized ridges and depressions. This is confirmed by the logs from the test borings in the wellfield area that indicate that the top of consolidated rock occurs at depths of between roughly 800 feet (MW-3) and 850 feet (MW-1, MW-4, and PW-1) to 1,200 feet (MW-2). These depths indicate that the maximum saturated thickness of the basin-fill deposits is similarly quite variable, ranging from approximately 132 feet at MW-5 to 700 feet at MW-2.

The total volume of ground water in storage within the uppermost 100 feet of saturated sediments in the Tule Desert has been estimated by NDWR (1971) to be approximately 530,000 acre-feet, based on a specific yield of 10 percent.

Recharge to ground water in the Tule Desert basin-fill deposits comes from direct precipitation on the surrounding upland areas, particularly those portions of the Clover Mountains and Tule Springs Hills that are within the watershed of the Tule Desert. Precipitation in these areas percolates down through the subsurface and reaches ground water in amounts proportional to elevation (that is, as elevation increases, so does the proportion that precipitation contributes to recharge).

Consistent with the approach most commonly taken in the hydrologic literature (Maxey and Eakin, 1949; Glancy and Van Denburgh, 1969; Prudic et al., 1995), precipitation that falls on the valley floor is conservatively assumed not to infiltrate and recharge ground water primarily because of the high potential for evaporation (see *Section 3.2, Surface Water Hydrology*). Dixon and Katzer (2002), however, believe that significant ground water recharge occurs through the infiltration of runoff in the principal ephemeral washes that feed the Toquop Wash (as well as from the Toquop Wash itself).

Specific estimates of ground water recharge in the Tule Desert vary from 2,100 afy (Glancy and Van Denburgh, 1969) to approximately 8,968 afy (Katzer et al., 2002). Recharge to the basin-fill deposits could also be occurring through upward leakage from the underlying fractured-rock aquifer, but this potential recharge component has not been quantified. The potential for interconnection between ground water in the basin-fill and the underlying rock is addressed further in the section below and in CH2M HILL (2002b), which also contains further elaboration on recharge estimates.

Within the Tule Desert, ground water is believed to flow through the basin-fill deposits toward the Toquop Gap, where some portion of the basin-fill ground water leaves the Tule Desert hydrographic area and enters the Virgin River Valley hydrographic area. The Toquop Gap, however, is too small to accommodate all of the basin-fill ground water discharge that, along with current local withdrawals and locally recharged spring flows, must balance the recharge estimates (that is, high-end estimates of the range of potential discharge rates through the basin-fill deposits in the Toquop Gap are much less than 10 afy [CH2M HILL, 2002b]). Therefore, some ground water in the basin-fill deposits must enter the underlying fractured-rock aquifer system and flow into the Virgin River Valley through that medium.

3.4.2.1.2 Ground Water in the Fractured Rock. The structural complexity that is evident in the surrounding Tule Springs Hills is mirrored, to a certain degree, in the fractured-rock that underlies the Tule Desert basin-fill deposits. Accordingly, the specific composition of the fractured-rock aquifer in the Tule Desert varies laterally across the basin as a result of vertical offset from faulting and local deposits of volcanic.

Detailed descriptions of the rocks encountered in the test boreholes in the proposed wellfield area are presented in CH2M HILL (2002b). In general the upper-most rock formation encountered is predominately composed of gray limestone interfingering with brown and red limey siltstone and bands of gray quartzite down to a depth of 2,000 feet in the vicinity of PW-1, MW-1, and MW-4. To the north, in the vicinity of MW-2, the

limestone component is generally absent and the limy siltstone component predominates.

The composition of the bedrock in the vicinity of PW-1, MW-1, and MW-4 is generally consistent with descriptions of the Triassic-aged (205 to 240 Ma) Moenkopi Formation as reported in the geologic literature (Tschanz and Pampeyan, 1970; Plume, 1996). The siltstone component is also similar to outcrops of the Moenkopi Formation in the Tule Springs Hills just east of the wellfield area (see Map 3-2). The Moenkopi is identified as being the uppermost (youngest) formation that contains aquifers in carbonate rock (Plume, 1996, Table 1). This is consistent with the predominance of limestone encountered in the boreholes in the vicinity of PW-1 and is supported by local water chemistry data, discussed below, which indicate that ground water from the fractured rock at the location of PW-1 and MW-4 is directly related to ground water in the regional carbonate aquifer system.

To the west at MW-3, Tertiary aged volcanic rocks are present to a depth of 2,000 feet. These volcanic rocks are part of the Clover Mountains, and include discrete layers of basalt, rhyolite, and tuff, interspersed with layers of clay up to 200 feet thick. These volcanic rocks likely extend under much of the northern third of the Tule Desert, and also likely comprise the bedrock beneath the basin fill south of the northern third of the Tule Desert along the eastern edge of the Clover Mountains.

All of the rock types encountered in the boreholes (limestone, siltstone, quartzite, and the various volcanic rocks) show evidence of fracturing, thus providing the void space to store and transmit ground water.

Despite the variation in the rock types that comprise the fractured-rock aquifer within the Tule Desert, ground water chemistry data, discussed in *Section 4.2.1.3, Ground Water Quality*, indicate a common ground water flow system within the different rock types, except at MW-3, as discussed below. For example, values of deuterium (a stable isotope of hydrogen contained in water molecules), which are used to help differentiate between waters of different origins (see CH2M HILL, 2002a; *Appendix A*), indicate similarities between ground water in an upgradient well MW-2 (deep), where fractured siltstone dominates, and ground water in downgradient wells PW-1 and MW-4, where carbonate rocks dominate. In both rock types, the ground water is highly depleted in deuterium. Specifically, deuterium values range from -98 per mil in MW-2 (deep) to -103 per mil in MW-4.

In addition, these water chemistry data also indicate a linkage between the ground water in the Tule Desert fractured-rock aquifer and regional carbonate-aquifer ground water. Along with being highly depleted in deuterium, the chloride concentrations are very low (approximately 8 mg/L) in both PW-1 and MW-4. The chloride data for MW-2 (deep) are considered to be unreliable (CH2M HILL, 2002a). These data collectively comprise a unique chemical signature that is only duplicated in ground water of the regional carbonate-aquifer system, which is similarly highly depleted in deuterium and typically does not provide a source of chloride (CH2M HILL, 2002a).

Further evidence that ground water in the fractured rock that underlies the Tule Desert basin-fill is part of the regional aquifer system of the carbonate-rock province comes from carbon-14 (C-14)

data. The application of C-14 data, which have been widely used for several decades to date items and substances containing carbon, is presented in CH2M HILL (2002a), *Appendix A*. The C-14 data from PW-1 indicate that the ground water in the fractured-rock at this location is very old because the unstable carbon content has almost completely decayed (0.9 percent modern carbon). In other words, the ground water from PW-1 originated as precipitation many tens of thousands of years ago and has taken that long to travel to the point where it could be extracted by

PW-1. Ground water of this age is consistent with the age of ground water in the regional carbonate-aquifer system, which similarly requires several thousand years to flow from the point of recharge across the carbonate-rock province.

Table 3-2 presents water-level data from fractured-rock wells in the Tule Desert.

These data indicate that water levels in wells that penetrate the fractured rock are typically very deep, but remain above the top of rock—further indicating that the ground water in the fractured rock is

TABLE 3-2
Ground Water Levels in the Fractured-Rock Aquifer in the Tule Desert

Well	Screened Interval (feet below surface)	Depth to Water (feet)	Water Level Elevation (feet above mean sea level)	Date
PW-1	1,000 to 1,160	724.2	2495.8	February 17, 2002
	1,200 to 1,240			
	1,340 to 1,380			
	1,440 to 1,480			
	1,500 to 1,520			
	1,540 to 1,560			
	1,580 to 1,780			
MW-2	1,435 to 1,540	506	3044	November 20, 2001
MW-3	920 to 960	484	3036	February 16, 2002
	1,000 to 1,060			
	1,100 to 1,140			
	1,480 to 1,520			
	1,700 to 1,760			
	1,800 to 1,840			
MW-4	1,920 to 1,980	718	2501	February 27, 2002
	1,108 to 1,148			

confined under pressure. This conclusion that the ground water is under pressure in the fractured rock is confirmed by the water level data from immediately adjacent basin-fill wells. These data reveal water levels that are different than the water levels in the rock.

When displayed spatially on a map, the water-level data from fractured rock also indicate that the horizontal component of the hydraulic gradient within the fractured rock is oriented in a southerly direction within the Tule Desert (CH2M HILL, 2002b). The magnitude of the horizontal component of hydraulic gradient is approximately 0.02, which is very steep but consistent with the relatively poor ability of the fractured rock to transmit water as discussed below.

Although the direction of ground water flow is dictated locally by the orientation of individual fractures, the direction of ground water flow is considered to be generally parallel to the direction of hydraulic gradient at the scale of the entire hydrographic area. In other words, the available water-level data indicate that ground water flows south through the Tule Desert.

These results are consistent with the findings of regional studies on the carbonate-rock aquifer systems that have concluded that the regional ground water flow in the fractured-rock aquifer is generally south in the vicinity of the Tule Desert and the northern portions of the Virgin River Valley hydrographic areas (Harrill and Prudic, 1998; Dettinger, 1992; Prudic et al., 1995).

Unlike ground water in the basin-fill deposits, ground water in the fractured rock is recharged in part outside the hydrographic area. Comparisons of water-

chemistry data from springs and wells north of the Tule Desert with similar data from the test wells in the proposed wellfield area indicate that ground water enters the Tule Desert fractured-rock aquifer north of the Clover Mountains.

Specifically, as mentioned above, the chemical signature of the ground water in the fractured rock at PW-1 and MW-4 is unique and is defined by the combination of highly depleted deuterium values (-103 per mil) and very low chloride concentrations (approximately 8 mg/L). Ground water from MW-2 (deep) is also highly depleted in deuterium (-98 per mil), but reliable chloride data from this fractured-rock well are unavailable.

The deuterium is indicative of ground water that originated (that is, was recharged) in a relatively cold, probably high altitude environment, much higher than any of the mountain areas that surround the Tule Desert including the Clover Mountains (CH2M HILL, 2002b).

Chloride concentrations in ground water typically only increase as ground water gains chloride ions from the fractured rock through which it flows. Carbonate rocks, however, are typically low in chloride and would not provide a source of chloride ions to ground water that flows through them. In addition, because chloride ions in ground water do not readily exchange with other anions in the rock, chloride concentrations in ground water typically do not decrease with distance along the path of flow. Accordingly, the low chloride concentrations in the vicinity of PW-1 and MW-4 is consistent with ground water that was recharged in a low chloride environment and stayed in such an environment (including carbonate and volcanic rocks) throughout its journey through the subsurface.

This combined (depleted deuterium/very low chloride) chemical signature is currently only known to exist in carbonate springs (Flat Nose, Delmues, and Bennett) in Dry Valley and Panaca Valley approximately 30 miles north of the northern edge of the Tule Desert hydrographic area. Ground water recharge to the Tule Desert must therefore involve southerly inter-basin ground water flow from Dry Valley through eastern Panaca Valley and eastern Clover Valley before entering the Tule Desert through faults and fractures in the subsurface volcanic rocks of the Clover Mountains.

In addition, the extremely low C-14 results (0.9 percent modern carbon) in PW-1, mentioned above, which is indicative of very old ground water, further support the premise that recharge to the fractured-rock aquifer in the Tule Desert occurred several miles north of the Tule Desert hydrographic area.

The data used to support these conclusions were obtained from Thomas et al. (2001) and Hydrosystems Inc. (2001), and are presented and analyzed in CH2M HILL (2002b).

Several conclusions about the ground water environment can be drawn based on the results of aquifer testing in the wellfield area, as described in CH2M HILL (2002b). The first conclusion is that the ability of the fractured-rock aquifer in the vicinity of PW-1 to transmit water (aquifer transmissivity) is relatively low. Specifically, the values of transmissivity for the fractured-rock aquifer obtained by pumping PW-1 were found to range between 14,500 and 27,000 gallons per day per foot of aquifer thickness (gal/day/ft).

Aquifer transmissivity, together with the magnitude of the horizontal component of hydraulic gradient, enables the amount of ground water flowing through the aquifer to be estimated by multiplying the product of these two parameters by a representative value of the width of the aquifer.

Accordingly, using a representative value of transmissivity (14,500 gal/day/ft, which is the lowest value calculated), together with the observed hydraulic gradient (0.02), and an assumed minimum representative value for the width of the Tule Desert for which these parameters apply (20,000 feet or approximately 3.8 miles), the flow through this portion of the Tule Desert (that is, in the vicinity of PW-1) is roughly 6,500 afy (CH2M HILL, 2002b).

Within the Tule Desert outside of this 4-mile wide width, the parameters in the aforementioned calculation are represented by other unknown values; consequently, ground water also flows within the Tule Desert fractured-rock aquifer outside and parallel to the 4-mile wide width selected for the calculation above. This additional amount (which would raise the total above 6,500 afy), however, cannot be reasonably calculated at this time.

In addition, significant additional ground water undoubtedly flows beneath the Tule Desert at depths deeper than that for which the transmissivity value obtained from PW-1 is representative and not included in the estimate above. PW-1 is approximately 1,800 feet deep (see Table 3-2) and additional unquantifiable amounts of ground water flows within deeper fractured-rock aquifer units (for example, deep Paleozoic carbonate rocks not encountered within the depths drilled to date) beneath the Tule Desert. This premise is supported by the existence of very deep (that is between 3,400 and 10,000 feet deep) wells that are reported to

penetrate the regional Paleozoic carbonate aquifer system (Dettintger et al., 1995, Table 6).

The ability of the aquifer to store ground water (storativity) was also determined from the aquifer tests. Values of storativity, which is the volume of water pumped by a well, per foot of water-level decline, per unit area of the fractured-rock aquifer, have been calculated to range between approximately 0.005 and 0.012. Small values of this order of magnitude indicate that pumping results in very little loss of ground water from storage and confirms the observation that the ground water is confined under pressure within the fractures of the rock. Based on the value of 0.005 for aquifer storativity, the volume of ground water within the uppermost portion (that is, an aquifer thickness of no more than 1,000 feet) of the fractured-rock aquifer is estimated to be approximately 400,000 acre-feet (CH2M HILL, 2002b).

The aquifer tests also revealed that water levels in the rock and overlying basin-fill deposits behave very similarly in response to pumping, although with much less water-level decline in the basin fill. As a result, it appears that there is significant hydraulic interconnection between the two aquifers, and that they effectively act as one unit at the scale of the wellfield area. In the vicinity of PW-1 and MW-4, the vertical component of hydraulic gradient is slightly upward, implying that ground water has a slight tendency to flow from the rock upward into the basin-fill deposits in this area.

Farther to the north and laterally upgradient, however, the vertical gradient is downward at MW-2. The downward gradient implies that ground water tends to flow from the basin-fill deposits into the

fractured rock at this location. Therefore, although the results of aquifer testing indicate that ground water in the basin fill and ground water in the fractured-rock aquifer responds to pumping essentially as a unit, ground water in the two aquifers originates from different sources and flows differently, if not independently, through the Tule Desert.

Available water-chemistry data indicate that within the Tule Desert the ground water in the basin fill and ground water in the fractured-rock aquifer have different chemical compositions that reflect different origins. Specifically, ground water in the fractured rock in the vicinity of PW-1 and MW-4 is chemically similar to the regional carbonate-rock aquifer system (for example, highly depleted deuterium, very low chloride, very low C-14, and no detectable tritium [an unstable isotope of hydrogen]). Tritium, if detected, is indicative of water less than 50 years old because tritium in precipitation originated with aboveground nuclear testing. Ground water in the basin-fill (based on data from the Tule Well and MW-5), however, is on the whole less depleted in deuterium, higher in chloride and has detectable tritium.

The results of the aquifer testing also provide insight into how much water individual wells can pump (well yield). Although PW-1 was found to sustain a pumping rate as high as 1,400 gpm for several days, the resulting water-level response indicates that long-term sustained rates of more than approximately 550 gpm are not practical for PW-1. Because of the spatial variability (heterogeneity) of the fractured-rock aquifer, the long-term yield of other wells could be more or less than 550 gpm.

3.4.2.1.3 Springs. Numerous small springs discharge ground water both within and around the Tule Desert (see Map 3-6). Most of these springs are in the Clover Mountains, but a few are located in the Tule Springs Hills and the East Mormon Mountains. The discharges from these springs typically are very low (all are less than 1 gpm and most are half that rate) (Walker, 2002).

In addition, several springs of regional importance lie outside of the project area. These springs include: the Littlefield Springs (see *Section 3.3, Surface Water Hydrology*); the Muddy Springs, located in Moapa Valley approximately 20 miles west-southwest of the project area; and the series of springs that rim the Overton Arm of Lake Mead.

Using water-chemistry data, principally deuterium, the general origin of the water that discharges from a given spring can be identified (see CH2M HILL, 2002b, Appendix A). The deuterium data from the springs within both the Tule Desert and the Virgin Valley hydrographic areas indicate that the springs are recharged by local precipitation and that the water likely travels a relatively short distance (on the order of a few miles or less) before discharging.

Specifically, higher values of deuterium (lower negative values) represent water that originated as precipitation at relatively lower elevations. The lowest elevation springs (for example, Gourd, Peach, Tule, Summit, Snow, Sam's Camp #4), are in the East Mormon Mountains and Tule Springs Hills, as well as the foothills of the Clover Mountains. These springs all have values of deuterium that range between -76.5 per mil (Peach Spring) and -83 per mil (Tule Spring) with most around -77 per mil.

Springs in the Mormon and Clover Mountains are typically at higher elevations than the Tule Spring Hills (for example, Davies, Horse and Hackberry in the Mormon Mountains; Garden, Box, Upper Box, Sam's Camp #1, #2 and #3, Shoemake #1, #2 and #3, Sheep, and Mud Hole in the Clover Mountains), and have correspondingly lower (higher negative) values of deuterium relative to the springs at lower elevations (that is, the springs are more depleted in deuterium). Specifically, the deuterium values for these Clover and Mormon Mountain springs are all in a narrow band between -86 per mil and -88 per mil.

Both sets of these deuterium values (that is, the values from the lowest elevation springs and the higher elevation Mormon and Clover Mountain springs) contrast with values of deuterium on the order of -100 per mil that correspond to deep, regionally flowing ground water in the carbonate aquifer systems. Accordingly, local recharge is the source for all of the springs that are near the wellfield area (Peach, Gourd, Tule, and Summit springs).

This is consistent with the findings by Prudic et al. (1995), who state that many small springs in the local mountains typically represent perched local systems that are not connected to surrounding and underlying ground water. See CH2M HILL (2002b) for further discussion on the origin of the discharge of the local springs.

The origin of the water that discharges from some of the principal springs outside the project area is regional, but not related to the ground water in the fractured-rock within the Tule Desert. Specifically, the sources of the Littlefield Springs reportedly include both a portion of the

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Virgin River that infiltrates upstream in Utah and emerges downstream at Littlefield, and local recharge from the Beaver Dam Mountains (Trudeau et al., 1983; Cole and Katzer, 2000). In addition, the available water chemistry data from the Littlefield Springs indicates that the spring discharge is chemically unrelated to the ground water in the fractured-rock aquifer within the Tule Desert. Specifically, relative to ground water from PW-1 and MW-4 in the Tule Desert, the Littlefield Springs are less depleted in deuterium, and contain significantly higher concentrations of chloride, sulfate, and total dissolved solids (TDS) relative to the test wells in the Tule Desert (see CH2M HILL, 2002b).

The source of water to the Muddy Springs, 20 miles west-southwest of the project area, is from the regional carbonate-rock aquifer system recharged north of the Clover Mountains, but the discharge of these springs has no relation to the ground water in the Tule Desert. A comparison of the water chemistry of these springs with ground water from PW-1 and MW-4 in the Tule Desert indicates that the Muddy Springs are less depleted in deuterium, and contain considerably higher concentrations of chloride and TDS.

The water that discharges from springs around the Overton Arm of Lake Mead has been found to be of multiple origins, with most of the discharge resulting from local recharge (such as the discharge at Kelsey Spring) (Pohlmann et al., 1998). Rogers Spring, however, appears to have a regional carbonate-aquifer origin, but from sources that are not common with the fractured-rock aquifer of the Tule Desert (Pohlmann et al., 1998). Specifically, relative to ground water from PW-1 and MW-4 in the Tule Desert, the discharge from Rogers Spring is much less depleted

in deuterium and is significantly higher in chloride and TDS.

3.4.2.2 Virgin River Valley Hydrogeology

3.4.2.2.1 Ground Water Occurrence.

Much of the Virgin River Valley sits above a deep structural depression in which the underlying bedrock is as much as 6 miles deep below the valley floor (see *Section 3.2, Soils and Geology*). As a result, accessible ground water largely only occurs in the various deposits that comprise the basin-fill material within this hydrographic area.

The basin-fill principally consists of the Muddy Creek Formation, which is typically overlain by a veneer of Older Alluvium where alluvial fans and terraces abut against the local mountains and hills (Glancy and Van Denburgh, 1969; Metcalf, 1995). The Older Alluvium, which consists of the full range of sediments from silt and clay to gravel and boulders, generally thickens toward the center of the valley, and is essentially indistinguishable from the Muddy Creek Formation. Along the floodplain of the Virgin River, the river has cut through the Older Alluvium and deposited sediments commonly referred to as Younger Alluvium (Woessner et al., 1981, Glancy and Van Denburgh, 1969).

3.4.2.2.2 Ground Water Recharge and

Flow. Ground water enters the Virgin River Valley from the north via the regional flow system described above that applies to the Tule Desert, and from areas to the east of the Tule Desert. Ground water also enters the Virgin River Valley from the east including recharge from Beaver Dam Wash and mountain-front recharge from the Beaver Dam and Virgin

mountains (Las Vegas Valley Water District, 1992). In addition, ground water in the Virgin River Valley is also recharged directly by the Virgin River, and locally by residual irrigation water applied to crops in the Virgin River floodplain (see *Section 3.3, Surface Water Hydrology*). Once in the Virgin River Valley, the direction of ground water flow is generally toward the southwest parallel to the Virgin River (Las Vegas Valley Water District, 1992; Dixon and Katzer, 2002).

Conceptually, ground water flow from the Tule Desert into the Virgin River Valley occurs primarily through the fractured-rock aquifer because there is very little direct linkage between saturated portions of the basin-fill materials of each hydrographic area (that is, Toquop Gap, which is much less than 1 mile wide, is the only area where basin-fill sediments of each area merge). Ground water flows from the Tule Desert generally southward in the fractured-rock until the rock is truncated by the north edge of the Virgin River Depression (CH2M HILL, 2002b). At that point ground water discharges into the basin-fill (Muddy Creek and underlying unconsolidated or semi-consolidated formations) of the Virgin River Depression. Once in the basin-fill aquifer system of the Virgin River Valley, ground water flows southwest, parallel to the Virgin River, toward the Overton Arm of Lake Mead (Las Vegas Valley Water District, 1992; Dixon and Katzer, 2002).

The published literature contains a range of estimates of the amount of ground inflow, including ground water recharge, to the Virgin River Valley. These estimates vary based on the assumptions and the data available to the authors. Glancy and Van Denburgh (1969) roughly estimated the combined inflow and recharge to be approximately 6,700 afy.

Prudic et al. (1995), using the USGS computer models of ground water flow through the regional carbonate aquifer system, estimated the flow to be approximately 14,000 afy. The computer-derived estimate, however, is based on very general assumptions for conditions. At the time of that analysis, for example, there were no available data from the Tule Desert. Recently, Dixon and Katzer (2002), have performed a comprehensive water-budget analysis on the Virgin River Valley and have concluded that the total recharge to the Virgin River ground water system is on the order of 85,000 afy.

3.4.2.2.3 Aquifer Characteristics. The transmissivity of the Muddy Creek Formation in the Virgin River Valley is reported to be relatively low with values typically less than 10,000 gal/day/ft (Johnson, 2000). Higher transmissivity areas within the Muddy Creek Formation have been discovered where faulting has reportedly facilitated the development of potential localized conduits between the Muddy Creek Formation and the underlying fractured rock (Johnson, 2000).

The total volume of ground water in storage within the uppermost 100 feet of saturated sediments in the Nevada portion of the Virgin River Valley has been reported by Las Vegas Valley Water District (1992) to be approximately 2.9 million acre feet, based on a specific yield of 10 percent.

Dixon and Katzer (2002) estimate that the available perennial yield of the basin-fill aquifer system in the Virgin River Valley is approximately 40,000 afy, after estimates of the current level of pumping (12,000 afy) are included. The perennial yield of a ground water basin is commonly defined as the rate at which water can be

withdrawn perennially without producing an undesirable effect (Todd, 1980).

3.4.2.2.4 Virgin River/Ground Water

Interaction. The Virgin River is essentially a “losing” river within the project area (see *Section 3.3.1.3, Surface Water Features*), which means that water from the river infiltrates the subsurface and recharges ground water. This conclusion is based on: 1) observed reductions in river flow in the downstream direction reported by Glancy and Van Denburgh (1969), Woessner (1981), and Metcalf (1995); 2) lower water levels for ground water relative to the elevation of the river, reported in Las Vegas Valley Water District (1992); 3) water-chemistry data indicating that the ground water in the Younger Alluvium immediately adjacent to the river is similar chemically to the Virgin River, but dissimilar to ground water in other basin-fill deposits (Older Alluvium and Muddy Creek Formation) (Metcalf, 1995); and 4) water-chemistry data indicating that the Virgin River downstream of Littlefield is composed exclusively of flows from Beaver Dam Wash, Littlefield Springs, and upstream (Utah) Virgin River flow.

The evidence that the local and regional ground water systems in the Virgin River Valley do not flow into the Virgin River is specifically addressed in CH2M HILL (2002b).

3.4.2.3 Ground Water Quality

3.4.2.3.1 Tule Desert. Based on water samples from the wells in the vicinity of the wellfield, the water quality of the basin-fill deposits appears to be generally very good. This conclusion, however, is based on data from only two wells that are screened exclusively in the basin-fill

deposits. The concentration of total dissolved solids (TDS) provides a general indication of water quality. TDS concentrations from MW-5 and the Tule Well are 320 and approximately 200 milligrams per liter (mg/L), respectively, which represents very good quality water. Based on samples from the Tule Well, the general character of the ground water in the basin-fill deposits is calcium-sodium sulfate.

The database on the quality of water in the fractured rock is also quite limited. TDS values from PW-1 and MW-4 are approximately 520 and 500 mg/L, respectively. These data are representative of good quality water, but not quite as good as the ground water in the overlying basin-fill. The general character of the ground water in the fractured rock is sodium sulfate, based on the chemical data from PW-1 (CH2M HILL, 2002a).

In addition to the generally lower values of TDS in the basin-fill ground water relative to the fractured-rock ground water, other differences in the chemistry and water quality between these two aquifers are indicative of the separate nature of these aquifers—despite their tendency to act hydraulically as a single unit in response to pumping. Specifically, when compared with the basin-fill aquifer, the values in the fractured-rock aquifer are: 1) significantly lower with respect to chloride; 2) significantly higher with respect to silica; and 3) significantly lower with respect to deuterium.

3.4.2.3.2 Virgin River Valley. Based on water-quality data described in Glancy and Van Denburgh (1969), Metcalf (1995), and Las Vegas Valley Water District (1992), the general character of the ground water in the floodplain of the Virgin River tends to be mixed cation (sodium,

potassium, magnesium), sulfate type water. Ground water from wells above the floodplain tends to have a composition of predominantly sodium sulfate plus chloride. The concentrations of TDS in wells along the river are very high with values ranging from approximately 2,100 mg/L to over 3,000 mg/L, indicating relatively poor-quality water. The TDS concentrations in wells above the floodplain are generally much lower—on the order of around 400 mg/L to 620 mg/L. Some of these wells above the floodplain, however, have TDS values that approach 2,000 mg/L.

Wells operated by the Virgin Valley Water District that penetrate the Muddy Creek Formation have had problems in the past producing water that meets drinking-water standards, but the water quality tends to improve in the immediate vicinity of faulted areas (Johnson, 2000).

3.4.2.4 Ground Water Use

3.4.2.4.1 Tule Desert. The basin-fill deposits in the Tule Desert are not extensively developed for water supply. Only one well that taps ground water in the basin-fill is known to exist within the Tule Desert. This well, known as the Tule Well (Map 3-5 in CH2M HILL [2002b]), supports seasonal livestock grazing. In addition, some springs in the Tule Desert hydrographic area, particularly in the Clover Mountains, have been tapped to provide stock water (for example, Sam's Camp No. 1, 2, and 3).

Ground water in the fractured-rock aquifer within the Tule Desert has not been developed.

3.4.2.4.2 Virgin River Valley. The basin-fill deposits, principally the Muddy Creek Formation, in the Virgin River Valley have been developed to supply both potable water to the communities of Mesquite and Bunkerville, and to provide water for irrigation along the Virgin River. Currently, the Virgin Valley Water District maintains wells in the Virgin River Valley (Map 3-5) from which approximately 4,000 acre-feet are pumped annually. Within the Arizona portion of the Virgin River Valley, ground water pumping for primarily agricultural use is reported currently to be approximately 8,000 afy (Dixon and Katzer, 2002). The current total ground water withdrawal from the Virgin River Valley hydrographic area is therefore approximately 12,000 afy.

In addition, springs along the eastern flanks of the East Mormon Mountains and Tule Springs Hills have been tapped to provide stock water (Tule, Gourd, and Snow Water springs).

Because of the tremendous depths to the underlying carbonate rocks within the Virgin River Valley, this source of ground water has not been developed.

3.4.3 Pah Rah Parcel

Ground water has not been developed or studied at the Pah Rah parcel. As a result, while ground water is undoubtedly present within the fractured volcanic rocks that underlie the parcel, the specific nature of the ground water resources are unknown. No wells or springs are present on the parcel.

3.5 Biological Resources

3.5.1 Threatened, Endangered, Candidate, and Sensitive Species

3.5.1.1 Toquop Area

The U.S. Fish and Wildlife Service (FWS) provided a list that identified federal- and state-listed plant and wildlife species that are protected, sensitive, or species of concern potentially occurring in the project area. *Appendix D* contains official correspondence from the FWS identifying listed species, candidate species, and species of concern that may occur within the vicinity of the proposed Toquop Energy Project. One federally listed species was identified as occurring in the project area: the threatened desert tortoise (*Gopherus agassizii*). Federally protected species associated with the Virgin River that were identified by the FWS were considered in assessing the potential for impact by the project as a result of ground water pumping. Those species are the endangered southwestern willow flycatcher (*Empidonax traillii extimus*), Yuma clapper rail (*Rallus longirostris yumanensis*), woundfin (*Plagopterus argentissimus*), Virgin River chub (*Gila seminuda*), and the candidate yellow-billed cuckoo, Western Distinct Population Segment (*Coccyzus americanus*).

3.5.1.1.1 Desert Tortoise. The project area is located within desert tortoise habitat. The area south and east of this area is the Mormon Mesa Area of Critical Environmental Concern (ACEC) for desert tortoise habitat (BLM, 2000). The southern plant site is also adjacent to two FWS-designated desert tortoise critical habitat units: Mormon Mesa Unit to the

south and the Beaver Dam Slope Unit to the east (FWS, 1994). Maps 3-7, 3-8, and 3-9 show desert tortoise habitat and critical habitat in relation to features of the Proposed Action and Alternative 3, Alternative 1, and Alternative 2, respectively.

Activity patterns of the desert tortoise are closely related to ambient temperatures and forage availability. Desert tortoises spend much of their lives in burrows, emerging to feed and mate during late winter and early spring. They remain active through the spring and portions of the summer through late fall. Their active season is typically defined as being from March 1 through October 31.

Existing threats to this species include direct and indirect human-caused mortality. Impacts such as destruction, degradation, and fragmentation of their habitat from urbanization, agricultural development, livestock grazing, mining, roads, vehicle-oriented recreational use, and losses from human take and disease have contributed to population declines (FWS, 1994).

Based on past surveys in the project area using the strip transect method, the project area supports a low-density desert tortoise population. Strip transects walked by Karl (1980) in and adjacent to the project area indicated tortoise population densities were very low (less than 10 tortoises per square mile). Strip transects walked in 1990 in the current right-of-way of the Kern River Gas Pipeline also recorded low sign counts with corresponding estimates of low densities of tortoises in the Toquop Wash area of the proposed project. Estimated densities were in the low range (10 to 45 tortoises per square mile) between mileposts 420 and 423 and in the very low range (zero to 10 tortoises per square mile)

between mileposts 423 and 424 (Dames & Moore, 1990a). The proposed power plant site is adjacent to the Kern River Gas Pipeline at approximately MP 422. Milepost numbers increase from east to west on the pipeline route.

The Sand Hollow permanent study plot is located approximately 5 to 6 miles east of the project area. Two samples of this study plot indicated a low density of desert tortoise. The plot was sampled in 1989 and again in 1994 with estimates of 8 and 15 tortoises per square mile, respectively (National Biological Service, 1995). Based on all data collection efforts in the project area, a reasonable estimate of desert tortoise density is approximately 11 tortoises per square mile. Project features and rights-of-way associated with the Proposed Action and Alternative 1 would be located on approximately 449 acres and 451 acres of desert tortoise habitat, respectively. Alternative 2 features and rights-of-way would be located on approximately 581 acres of desert tortoise habitat. Alternative 3 features and rights-of-way would be located on approximately 417 acres of desert tortoise habitat.

3.5.1.1.2 Southwestern Willow

Flycatcher. The southwestern willow flycatcher is a federally listed endangered species. It is a small bird with a grayish-green back and wings, whitish throat, light grey-olive breast, and pale yellowish belly. The breeding range of the southwestern willow flycatcher includes Arizona, southern California, New Mexico, the extreme southern parts of Utah and Nevada, southwestern Texas, and extreme northwestern Mexico. The habitat of this species includes riparian habitats along rivers, streams, or other wetlands with a dense growth of willows (*Salicaceae*), arrowweed (*Pluchea sevicea*), and

tamarisk (*Tamaricaceae*), often with a scattered overstory of cottonwood (*Salicaceae populus*) (FWS, 1995). Breeding usually occurs in swampy thickets with willow and buttonbrush (American Ornithologists Union, 1983). During migration, southwestern willow flycatchers use a variety of habitats and may be encountered in all but the most sparse, desert habitats. These habitats do not exist on any of the project feature sites.

3.5.1.1.3 Yuma Clapper Rail. The Yuma clapper rail is a federally listed endangered species. Its preferred habitat is sedimented, shallow water cattail (*Typha latifolia*) and bulrush (*Scirpus acutus*) marshes. The Yuma clapper rail nests primarily in freshwater marshes in mature cattail-bulrush habitat. Nests are commonly found at or near the water's edge. Stands of cattail and bulrush dissected by narrow stream channels apparently support the densest populations of Yuma clapper rails. The closest potential habitat is on the Virgin River.

3.5.1.1.4 Woundfin. The historical range of the woundfin, an endangered fish species, included the Salt, Verde, and Gila rivers in Arizona; the lower Colorado River; and the Virgin River in Utah and Nevada. This species has been extirpated from most of its historical range except for the Virgin River. Presently, the woundfin's range in the Virgin River extends from La Verkin Springs in Utah downstream to Lake Mead (Virgin River Fishes Recovery Team, 1985). Woundfin also occur in the lower portions of La Verkin Creek in Utah, which is a tributary to the Virgin River. Critical habitat has been designated for this species in the Virgin River and its 100-year floodplain from its confluence with La Verkin Creek

Map 3-7 (11 x 17; color) page 1 of 2

Map 3-7 (11 x 17; color) page 2 of 2

Map 3-8 (11 x 17; color) page 1 of 2

Map 3-8 (11 x 17; color) page 2 of 2

Map 3-9 (11 x 17; color) page 1 of 2

Map 3-9 (11 x 17; color) page 2 of 2

in Utah downstream to Halfway Wash in Nevada.

3.5.1.1.5 Virgin River Chub. The Virgin River chub, an endangered fish species, historically occurred in the mainstem Virgin River from La Verkin Springs, Utah, downstream to the confluence with the Colorado River in Nevada (Virgin River Fishes Recovery Team, 1985). The present distribution of this fish species includes the mainstem Virgin River from La Verkin Springs, Utah, downstream to near the Mesquite Diversion, Nevada. Another distinct population, which is isolated by Lake Mead, occurs in the middle and upper portions of the Muddy River in Nevada. Critical habitat has been designated for this species in the Virgin River and its 100-year floodplain from the confluence with La Verkin Creek in Utah downstream to Halfway Wash in Nevada. This critical habitat designation is the same area as designated for the woundfin.

3.5.1.1.6 Candidate Species, Yellow-Billed Cuckoo. Yellow-billed cuckoo is a candidate for listing as threatened or

endangered west of the Rocky Mountains. While this species is relatively common east of the Rocky Mountains, there is concern for loss or degradation of the species' riparian habitat in the West. Its breeding range formerly included most of North America from southern Canada to Mexico. Western yellow-billed cuckoos breed in large blocks of riparian habitats, particularly woodlands with cottonwoods and willows. Dense understory foliage appears to be an important habitat feature. The closest occupied habitat to the project area is the Virgin River (FWS, 2001).

3.5.1.1.7 Species of Concern and Other Sensitive Species. Table 3-3 lists species of concern identified during consultation with the FWS (2001) (see *Appendix D*) as potentially occurring within the vicinity of the project area. Banded Gila monsters (*Heloderma suspectum cinctum*) are protected from collection and killing under Nevada law (Nevada Revised Statute [NRS] 501.110). This species is more common in mountainous areas; however they could occur virtually anywhere in the project area.

TABLE 3-3

Species of Concern that may Occur Within the Vicinity of the Proposed Toquop Energy Project, Lincoln and Clark Counties, Nevada

Common Name	Scientific Name
Birds	
Western burrowing owl	<i>Athene cunicularia hypugea</i>
Black tern	<i>Chlidonias niger</i>
Blue grosbeak	<i>Guiraca caerulea</i>
American peregrine falcon	<i>Falco peregrinus anatum</i>
Least bittern	<i>Ixobrychus exilis hesperis</i>
Phainopepla	<i>Phainopepla nitens</i>
Summer tanager	<i>Piranga rubra</i>
White-faced ibis	<i>Plegadis chihi</i>

TABLE 3-3

Species of Concern that may Occur Within the Vicinity of the Proposed Toquop Energy Project, Lincoln and Clark Counties, Nevada

Common Name	Scientific Name
Vermilion flycatcher	<i>Pyrocephalus rubinus</i>
Lucy's warbler	<i>Vermivora luciae</i>
Arizona Bell's vireo	<i>Vireo bellii arizonae</i>
Fish	
Virgin spinedace	<i>Lepidomeda mollispinis mollispinis</i>
Mammals	
Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff bat	<i>Eumops perotis californicus</i>
Allen's big-eared bat	<i>Idionycteris phyllotis</i>
California leaf-nosed bat	<i>Macrotus californicus</i>
Small-footed myotis	<i>Myotis ciliolabrum</i>
Long-eared myotis	<i>Myotis evotis</i>
Fringed myotis	<i>Myotis thysanodes</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Pale Townsend's big-eared bat	<i>Corynorhinus townsendii pallescens</i>
Amphibians	
Arizona southwestern toad	<i>Bufo microscaphus microscaphus</i>
Relict leopard frog	<i>Rana onca</i>
Reptiles	
Banded Gila monster	<i>Heloderma suspectum cinctum</i>
Chuckwalla	<i>Sauromalus obesus</i>
Plants	
Threecorner milkvetch	<i>Astragalus geyeri</i> var. <i>triquetrus</i>
Sticky buckwheat	<i>Eriogonum viscidulum</i>
Beaver Dam scurfpea	<i>Pediomelum castoreum</i>

*Species list provided by FWS (2001) (see Appendix D).

Although not formally protected by federal law, the chuckwalla (*Sauromalus obesus*) is considered rare and protected by the Nevada Department of Wildlife (NDOW) and as a special status (sensitive) species

by the BLM. Chuckwalla habitat in the project area is rocky outcrops (including exposed caliche strata) and/or heavily bouldered terrain.

Like the woundfin and Virgin River chub, the Virgin spinedace (*Lepidomeda mollispinis mollispinis*)—another fish species—is dependent on aquatic habitats of the Virgin River.

With the exception of domestic pigeons (*Columbina passerina*), house sparrows (*Passer domesticus*), and European starlings (*Sturnus vulgaris*), all birds in the project vicinity are protected under the Migratory Bird Treaty Act of 1918 (MBTA), as amended (16 United States Code [U.S.C.] 703-712). Suitable habitat for the burrowing owl (*Athene cunicularia hypugea*) occurs throughout the project area. Because burrowing owls are year-round residents in the area, the potential for impact is high. Burrowing owls are often found in the same habitat as desert tortoises because they utilize abandoned desert tortoise burrows. The burrowing owl is protected under the MBTA, which states that it is unlawful to take, kill, or possess migratory birds (16 U.S.C. 703-711). Potential for impacts on migratory birds is primarily a concern during the breeding season, which occurs during the spring and summer for burrowing owls. Other bird species of concern listed in Table 3-3, as well as the yellow-billed cuckoo (*Coccyzus americanus*) which is a FWS candidate species, are found in the region and have the potential to pass through the project area as migrants or occasional visitors.

Many types of bats that could potentially occur in the project area are also considered species of concern by the FWS. These bat species are identified in Table 3-3. All but four of the bat species listed in Table 3-3 are considered sensitive species by the BLM. The four that are not listed are the greater western mastiff bat, fringed myotis, long-legged myotis, and Yuma myotis (BLM, 1999). Although

such habitats are unusual, certain naturally occurring caves and even some abandoned mines, can provide the necessary temperature regimes for bats. The continued presence of such features is critical to maintaining some local bat populations; however, no specific sites like these have been identified at project feature sites.

Three plant species of concern listed in Table 3-3 were identified for field surveys as a result of a species list requested from the FWS. Subsequently, information regarding these species' habitats and blooming times was reviewed as a part of these biological studies. Field surveys were conducted at the southern Toquop power plant site on April 17, 2001, for beaver dam scurfpea (*Pedimelum castoreum*) and threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*), and on May 16, 2001, for sticky buckwheat (*Eriogonum viscidulum*). This second survey was necessary because sticky buckwheat flowers approximately 3 to 4 weeks later than the milkvetch species. The surveys conducted were timely for the species occurrence and extensive.

Resource Concepts, Inc., presented their survey methods, species review, study results, conclusions reached, and copies of correspondence from the Nevada Department of Conservation and Natural Resources, Nevada Natural Heritage Program, in a report titled "Cogentrix Project, Plant Species of Concern, Survey Results" (Resource Concepts Inc., 2001a). The Resource Concepts study conclusion is presented in the text below.

The dominant parent material throughout the entire survey area—older (Tertiary) lacustrine deposits overlying carbonate rock—seems to not weather into a coarse enough soil (sand) to support the

necessary habitat for the species of concern in this area. Where soils were dominated by limestone bedrock the weathering actions seemed again to create soil that was fine-grained and shallow, with no associated sand dunes or dune edges. The numerous washes in the area, particularly the Toquop Wash, did have sandy sites normally just above the active scoured channel. Sand-adapted species, especially the Nye milkvetch, were quite common in these areas, though none of the endangered species were found. Large expanses of habitat not associated with these species between the washes could greatly reduce seed sources that could take advantage of the available habitat associated with the washes. The surveys conducted were timely for the species occurrence and extensive. The area did not contain the target plants: *Astragalus*, *Erigeron*, or *Pedimelum*.

3.5.1.2 Pah Rah Parcel

The Pah Rah parcel has not been identified or proposed as significant or critical habitat for any wildlife species. Field reviews of the area for wildlife were conducted in April, May, and November 2001. During the field reviews, sage grouse (*Centrocercus urophasianus*) sign was common with possible lek areas observed in the central portion of the parcel. In addition, two sage grouse—a species of concern—were observed during the November field review.

Five BLM-sensitive plant species were identified for field surveys. The species are altered andesite buckwheat (*Eriogonum robustum*), Lemmon buckwheat (*Eriogonum lemmonii*), Webber ivesia (*Ivesia webberi*), Nevada oryctes (*Oryctes nevadensis*), and Nevada suncup (*Camissonia nevadensis*). Field reconnaissance on the Pah Rah parcel was

conducted on May 15, 2001, and none of these plant species were identified.

3.5.2 Native Vegetation, Invasive Species, and Noxious Weeds

3.5.2.1 Toquop Area

The Toquop area lies within the Mojave Desert biome. Vegetation communities within this biome and represented at the Toquop area can be further characterized as southern desert shrub and northern desert shrub. The topography is characterized by high mountain ranges with intervening valleys and canyons featuring broad alluvial fans and bajadas. Climate of the Mojave Desert is typified by hot dry summers and cool dry winters with annual precipitation ranging between 4 and 12 inches. Southern desert shrubs generally occur between 1500 and 5000 feet in elevation. The vegetation in the Toquop area is representative of a more mesic portion of the Mojave Desert based upon the dominance/presence of black brush (*Coleogyne ramosissima*) on most sites and elevations mostly above 2100 feet.

Plants representative of the southern desert shrub community include creosote (*Larrea tridentata*), shadscale (*Atriplex confertifolia*), white bursage (*Ambrosia dumosa*), Joshua tree (*Yucca brevifolia*), Mojave yucca (*Yucca schidigera*), and Mormon tea (*Ephedra nevadensis*).

Associated species include range ratany (*Krameria parvifolia*), desert trumpet (*Eriogonum inflatum*), big galleta (*Hilaria rigida*), Indian ricegrass (*Oryzopsis hymenoides*), and spiny hopsage (*Grayia spinosa*). The northern desert shrub plant community is characterized by black brush, creosote, yuccas, bursage, rabbit brush (*Chrysothamnus* spp.), snake weed

(*Gutierrezia* spp.), big galleta, Indian ricegrass, and sand dropseed (*Sporobolus cryptandus*). Cactus species such as beavertail (*Opuntia basilaris*), staghorn cholla (*Opuntia acanthocarpa*), hedgehog (*Echinocereus engelmannii*), and barrel cactus (*Ferocactus wislizenii*) are present throughout the project site. The following species are common in all portions of the Toquop area: Joshua trees (*Yucca brevifolia*), creosote bush (*Larrea tridentata*), white bursage (*Ambrosia dumosa*), Nevada ephedra, turpentine broom (*Rutaceae Thomnosina*), white burrobush (*Ambrosia dumosa*), filaree (*Erodium cicutarium*), desert trumpet (*Eriogonum inflatum*), annual phacelia (*Phacelia*), fiddleneck (*Amsinckia*), and red brome (*Bromus*). Exceptions are the gypsiferous soils located just north of the Toquop Wash and the active wash channels that support distinctive vegetation. Additional species found in the wash include desert willow (*Bignoniaceae chiliopsis*), western mugwort (*Artemisia ludoviciana*), desert poppy (*Papaveraceae Arctomecon*), sweet clover (*Crossosomataceae melilotus*), robust fourwing saltbush (*Atriplex canescens*), rabbit brush (*Chrysothamnus* spp.), Mojave aster (*Machaeranthera tortifolia*), and desert needlegrass (*Stipa speciosa*). Salt cedar (*Tamarix ramosissima*), a noxious weed, is present in the Toquop Gap. The entire project area supports various cacti species, yuccas, and Joshua trees. All species in the cactus family (Cactaceae) and members of the genus *Yucca* and *Agave* are protected by Nevada State Law (NRS 527.060-.120).

All drainages along the roads were observed to support rabbit brush, fourwinged saltbrush, and an annual lupine (*Lupinus*). These species were unique to the drainages. The introduced winter annual filaree (*Erodium*

cicutarium) dominated the interspaces between shrub species on all the sites surveyed with the exception of the washes. The washes contained annual lupine, popcorn flower (*Plagiobothrys* spp.), small flowered blazing star (*Mentzelia minutiflora*), and bladder sage (*Labiatae salazaria*). Indian paintbrush (*Castilleja chromosa*) grew under protective shrubs along with isolated occurrences of desert larkspur (*Loasaceae mentzelia*).

Within the project area four genera of invasive, non-native plant species have been observed. The most common are annual grasses in the genus *Shismus*, commonly known as Mediterranean grass, and *Bromus*. In some areas these two genera have been reported to account for up to 100 percent of the ground cover. Prevalence of these grasses is greatly dependent on rainfall and temperature. Both thrive on disturbed soils. In some areas Russian thistle (*Salsola iberica*) and tamarisk (*Tamarix ramosissima*) are common. Tamarisk is on the Ely District Weed List; and red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), and Russian thistle have been identified as injurious plants within the Ely District (BLM, 1999; FERC and CSLC, 2002). Thirteen species of noxious weeds on the Nevada State Weed List have been identified as occurring in the Ely District (BLM 1999). However, none of these species were observed in the Project Area during field surveys and they have not been reported as occurring in the area in any documents reviewed for the project. All these invasive, non-native plants, except Mediterranean grass, are considered noxious weeds by the BLM (1999).

3.5.2.2 Pah Rah Parcel

The Pah Rah parcel supports a fairly monotypic vegetation community

represented by a few annual and perennial plants described below. The Pah Rah parcel is undisturbed habitat containing no roads and is accessible only by foot. The parcel is typical of other relatively undisturbed habitats at similar elevations in the surrounding area.

Vegetation within the subject property is typical of the Great Basin Desert. Shrub vegetation is fairly uniform throughout the area. Shrubs include bud sage (*Artemisia spinescens*), spiny hop sage (*Grayia spinosa*), big sage (*Artemisia tridentata*), fourwinged saltbrush (*Atriplex canescens*), and green rabbit brush (*Chrysothamnus* spp.). Flowering plants identified during surveys include phlox (*Plemoniaceae Phlox*), Indian paintbrush, and bitterroot (*Lewisia rediviva*). Lichens are abundant on rocky surfaces. Temperatures typically vary from approximately 40°F in winter to 100°F in summer. Average annual precipitation (in Washoe County) varies from approximately 4 to 16 inches. The majority of the section is relatively flat. The highest elevation is 6253 feet (along the western boundary), and the lowest elevation is 5299 feet.

Noxious weeds were not noted during the field reconnaissance in May. There are no records indicating the presence of noxious weeds on the parcel. Because of the remote nature of the parcel and the lack of roads, it is unlikely that noxious weeds are present.

3.5.3 Wild Horses and Burros

On December 15, 1971, Congress enacted the Wild and Free-Roaming Horse and Burro Act, authorizing the BLM to manage wild horses and burros on the

public lands and mandating that wild and free-roaming horses and burros be protected from unauthorized capture, branding, harassment, or death. Those areas of public land that were used as habitat for wild horses and burros in 1971 were delineated as Herd Management Areas (HMA). The BLM's policy is to protect, manage, and control wild horses and burros on public lands.

3.5.3.1 Toquop Area

The proposed south Toquop parcel (plant site) is not within an identified HMA; however, the proposed wellfield/pipeline and adjacent north Toquop parcel (plant site) are located within two HMAs. The proposed wellfield enters the northeast portion of the Mormon Mountain HMA, which has an Appropriate Management Level (AML) set at zero for wild horses. The northern portion of the wellfield lies within the Blue Nose Peak HMA. The AML for the Blue Nose Peak HMA is currently being set through the Multiple Use Decision process. No wild horses or burros were observed during field surveys. Wild horses use the northern portion of the wellfield at various times of the year to utilize existing livestock water improvements.

3.5.3.2 Pah Rah Parcel

The Pah Rah parcel is located in a Herd Area for wild horses and burrows and is managed by BLM as a "horse free" area because these animals are not compatible with the increased development in the area. No wild horses or burros were observed during the spring field reconnaissance surveys.

3.5.4 Wildlife and Fisheries Resources

3.5.4.1 Toquop Area

The parcel supports a diversity of wildlife species common to the desert habitats. Numerous previously identified reptile, rodent, bird, and small mammal species inhabit or utilize this parcel. The desert tortoise, a federally listed species, is known to occupy this parcel. The parcel does not support a dense population of desert tortoise.

A wide variety of terrestrial species presently occupies and/or otherwise uses the project area. Fish are absent from the project area because of the lack of suitable aquatic environments.

3.5.4.1.1 Amphibians. Amphibian species potentially occurring within the area include the Great Basin spadefoot (*Scaphiopus intermoutonus*), western toad (*Bufo boreas*), red-spotted toad (*Bufo punctatus*), Great Plains toad (*Bufo cognatus*), and the leopard frog (*Rana pipiens*). These highly desert-adapted species occur throughout the Mojave Desert region. The somewhat less-desert-adapted Woodhouse's toad (*Bufo woodhousei*) might also be expected within moist areas.

3.5.4.1.2 Reptiles. A wide variety of reptile species occupies the project area. Southern Nevada deserts support at least 16 lizard species, many of which occupy the Toquop area. These include side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), zebra-tailed brush lizard (*Urasaurus graciosus*), desert horned lizard (*Phrynosoma platyrhinos*), desert iguana (*Dipsosaurus dorsalis*), chuckwalla

(*Sauromalus obesus*), long-nosed leopard lizard (*Gambelia wislizenii*), desert collared lizard (*Crotaphytus insularis*), banded gecko (*Coleonyx variegatus*), and Gila monster.

Eighteen snake species occur locally and, as with the lizards, several can be found in the project area. These include western blind snake (*Leptotyphlops humilis*), ground snake (*Sonora semiannulata*), spotted leaf-nose snake (*Phyllorhynchus decurtatus*), red racer (*Masticophis flagellum*), patch-nosed snake (*Salvadora hexalepis*), gopher snake (*Pituophis melanoleucus*), glossy snake (*Arizona elegans*), long-nosed snake (*Rhinocheilus lecontei*), king snake (*Lampropeltis getulus*), night snake (*Hypsiglena torquata*), lyre snake (*Trimorphodon biscutatus*), sidewinder or horned rattlesnake (*Crotalus cerastes*), Mojave rattlesnake (*C. scutulatus*), and speckled rattlesnake (*C. mitchellii*).

3.5.4.1.3 Migratory Birds. A wide variety of avian species either occupies or migrates through the Toquop area. Some typical nesting species of local, open desert environments are the black-throated sparrow (*Amphispiza bilineata*), cactus wren (*Campylorhynchus brunneicapillus*), horned lark (*Eremophila alpestris*), greater road runner (*Geococcyx californianus*), ash-throated flycatcher (*Myiarchus cinerascens*), Say's phoebe (*Sayornis saya*), verdin (*Auriparus flaviceps*), loggerhead shrike (*Lanius ludovicianus*), mourning dove (*Zenaida macroura*), and Gambel's quail (*Callipepla gambelii*).

In the more rugged upland and canyon locales, rock wren (*Salpinctes obsoletus*), raven (*Corvus corax*), barn owl (*Tyto alba*), great-horned owl (*Bubo virginianus*), prairie falcon (*Faleo mexicanus*), American kestrel (*Faleo*

sparverius), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), and turkey vulture (*Cathartes aura*) can also be considered as likely locally nesting species.

Virtually all migrant species using western flyways potentially pass through this area during their spring and fall migrations.

Gambel's quail habitat occurs throughout the entire project area. Higher concentrations of quail can be expected around the major washes, cattle stock tanks, and springs that occur on the proposed project plant and well sites, access roads, and utility corridors. Numerous coveys of quail were observed during surveys of the Toquop area.

3.5.4.1.4 Mammals. Several carnivores occupy the various habitats that occur throughout or near the project area. Bobcat (*Lynx rufus*), coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), gray fox (*Urocyon cinereoargenteus*), and badger (*Taxidea taxus*) might reasonably be encountered in suitable habitats along the various utility corridors. Mountain lion (*Felis concolor*) is a possible occupant of the Mormon Mountain uplands.

Various other mammals also inhabit the project area. Typical species include black-tailed jackrabbit (*Lepus californicus*), desert cottontail rabbit (*Sylvilagus audubonii*), desert wood rat (*Neotoma lepida*), white-tailed antelope ground squirrel (*Ammospermophilus leucurus*), round-tailed ground squirrel (*Citellus tereticaudus*), pocket gopher (*Thomomys bottae*), kangaroo rat (*Dipodomys* sp.), various cricetid mice (*Onychomys* sp., *Reithrodontomys megalotis*, *Peromyscus* sp.), and pocket mice (*Perognathus* sp.). Bighorn sheep (*Ovis canadensis nelsoni*) and mule deer

(*Odocoileu hemionus*) are managed by NDOW (NRS 501) and occupy mountainous areas through which the various alignments pass along the East Mormon Mountains.

3.5.4.2 Pah Rah Parcel

The monotypic vegetation community which characterizes the parcel (see *Section 3.5.2.2, Pah Rah Parcel*) contains a diversity of wildlife species. Numerous reptile, bird, rodent, and other small mammals previously described inhabit or use this parcel. Large mammals such as pronghorn antelope have been frequently observed on the parcel. Mule deer are likely infrequent visitors. Use of this parcel by sage grouse, a Nevada-listed and BLM sensitive species, is an additional wildlife value.

3.5.4.2.1 Amphibians. The Great Basin spadefoot and western toad may occupy the Pah Rah parcel.

3.5.4.2.2 Reptiles. Several species of reptiles are known or expected to occur on the subject parcel. Lizard species include the zebra-tailed, leopard, collared, desert spiny (*Sceloporus magister*), western fence sagebrush (*Sceloporus graciosus*), side-blotched, northern desert horned (*Phrynosoma platyrhinos*), western skink (*Eumeces kiltonianus*), and western whiptail (*Cnemidophorus tigris*). Snake species potentially occurring at the site include the rubber boa (*Charina bottae*), red racer, striped whipsnake (*Masticophis taeniatus*), western patch-nosed, gopher, California kingsnake, long-nosed snake, western garter snake (*Thamnophis elegans*), western ground snake, night snake, and the Great Basin rattlesnake (*Crotalus lutesus*).

3.5.4.2.3 Migratory Birds. A wide variety of bird species either occupies or migrates through the project area. Typical nesting species likely to use the site include: chukar (*Alectoris* sp.), morning dove, burrowing owl, western flycatcher (*Empidonax difficilis*), green-tailed towhee (*Pipilo chlorurus*), house finch (*Carpodacus mexicanus*), western kingbird (*Tyrannus vociferans*), horned lark, rock wren, canyon wren (*Catherpes mexicanus*), sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), and black-throated sparrow.

3.5.4.2.4 Mammals. Several carnivores are expected to occupy or use the Pah Rah parcel. Bobcat, coyote, kit fox, and badger are likely to be present on this parcel. Mountain lions may occasionally utilize this area during hunting forays. Other common species present, or likely to be present, at this site include black-tailed jackrabbit, yellowbelly marmot (*Marmota flaviventris*), Townsend ground squirrel (*Citellus townsendi*), least chipmunk (*Eutamias minimus*), white-tailed antelope ground squirrel, northern pocket gopher, pocket mice, various cricetid mice, mountain cottontail (*Sylvilagus nuttalli*), mule deer, and pronghorn antelope.

3.5.5 Wetlands/Riparian Zones, Floodplains, and Waters of the United States

The identification of wetlands, rivers, and streams within the project area was based on review of the 1:24,000-scale U.S. Geological Survey (USGS) topographic maps and several field reconnaissance surveys conducted at the Toquop sites in November 2001. National Wetland Inventory (NWI) maps, which are prepared by the FWS, have not been prepared for the proposed sites. The

identification of floodplains is based on the Federal Emergency Management Agency (FEMA) floodplain maps.

Areas inspected for the presence of ephemeral washes or other potential waters of the United States (such as wetlands or aquatic areas) included the proposed plant sites, well sites, access roads, and western and eastern pipeline/utility alignments. The delineation of areas potentially within U.S. Army Corps of Engineers (USACE) jurisdiction included those areas within the ordinary high water mark (OHWM). The proposed jurisdictional limits were delineated at the OHWM as identified by sediment lines, debris marks, or natural banks. The locations of the potential waters of the United States were recorded by a global positioning system (GPS) unit and marked on topographic maps of the project area.

3.5.5.1 Toquop Area

Numerous ephemeral washes convey runoff from the surrounding hillsides. The primary named ephemeral washes within the Toquop area are Halfway Wash, near I-15, between the Mormon Mountains and East Mormon Mountains; Toquop Wash and South Fork Toquop Wash, east of the East Mormon Mountains; Sam's Camp Wash, north and west of the Tule Springs Hills; and Garden Wash. Many of these ephemeral washes are classified as waters of the United States and are subject to the requirements of Section 404 of the Clean Water Act (CWA).

Wetlands or other aquatic areas are found near springs in the Toquop area and along the Virgin River. These are shown on Map 3-6, in *Section 3.4, Ground Water Resources*.

According to the FEMA floodplain map (Map Index Community Panel Number 320014 0001-5525), the Toquop area is located in Zone D. Zone D is defined on the FEMA map as “areas of undetermined, but possible, flood hazards.”

3.5.5.2 Pah Rah Parcel

Perennial water bodies and waters of the United States are not present within the Pah Rah parcel. No wetlands, other aquatic areas, or riparian vegetation are present within the Pah Rah parcel.

3.6 Air Quality and Noise

3.6.1 Air Quality

3.6.1.1 Toquop Area

3.6.1.1.1 Climate and Meteorology.

The locations of the Proposed Action and Alternatives 1, 2, and 3 are in the southeast desert region of Nevada. Moderate to hot temperatures, low humidity, and minimal annual rainfall typify the region. The region actually has four well-defined seasons, although they differ from the traditional view of seasonal variation. Summers display classic southwest desert characteristics. Daily high temperatures typically exceed 100°F with lows in the 70°F range. The summer heat is tempered somewhat by the extremely low relative humidity. However, it is not uncommon for humidity to increase markedly for several weeks each summer in association with a moist monsoonal flow from the south, typically during July and August. Aside from increasing the discomfort level, these moist winds also support the development of desert thunderstorms, which are frequently associated with significant flash flooding and/or strong downburst winds.

Winters, on the whole, are mild. Afternoon temperatures average near 60°F, and skies are mostly clear. Pacific storms occasionally produce rainfall in the southern Nevada desert, but in general, the Sierra Nevada Mountains of eastern California and the Spring Mountains immediately west of the Las Vegas Valley act as effective barriers to moisture. Snow accumulation is rare in the lower desert region. Flurries are observed once or twice during most winters, but snowfall of 1 inch or more occurs only once every 4 to 5 years. However, freezing temperatures do occur with some regularity. Based on the 1961 to 1990 period of record, the average first occurrence of 32°F in the fall is November 25; the average last occurrence is February 28.

The spring and fall seasons are generally considered ideal. Although rather sharp temperature changes can occur during these months, outdoor activities are seldom hampered. Strong winds are arguably the most persistent and provoking weather hazard experienced in the area. Winds over 50 miles per hour (mph) are infrequent but can occur with some of the more vigorous storms. Winter and spring wind events often generate widespread areas of blowing dust and sand. Strong wind episodes in the summertime are usually connected with thunderstorms, and are thus more isolated and localized. Prevailing wind direction is typically southwesterly, unless associated with a thunderstorm outflow.

Surface winds are characterized by prevailing southwesterly winds with an average speed of approximately 10 mph. Wind speeds are lowest during the winter season with an average of approximately 8 mph. Spring is typically the windiest season with an average wind speed of approximately 12 mph.

Figure 3-1 shows a wind rose for the Toquop area. The wind rose graphically depicts a plot of one year of hourly wind speed and vector recordings, from 1990, and should be representative of overall annual observations for any year. Wind data for the chart were taken from the National Weather Service station in Las Vegas (LAS), the nearest station with publicly available data.

Temperatures range from an average daily maximum of 60.2°F in January to 105.5°F in July. Average daily minimum temperatures range from 43.2°F in January to 67.2°F in July.

The region is one of the driest in the U.S., receiving an annual average precipitation of only 6.9 inches. Monthly precipitation ranges from 0.16 to 0.89 inch.

During the rainy period (July to September), local terrain influences both the winds and rainfall patterns. Moisture from the tropics enters the region from the south and east, interacts with local terrain-influenced upslope winds and intense surface heating, and produces high-altitude convective thunderstorms. These storms may produce significant rainfall, however, rainfall amounts vary considerably from location to location because of the spatial and temporal variation of these types of storm systems.

3.6.1.1.2 Physical Features of Site

Proposed Action. The Proposed Action power plant site would be approximately 12 miles northwest of Mesquite. The East Mormon Mountains lie west of the plant site; the plant would be approximately 5 miles east of the peaks and 3 to 4 miles east of the base of these mountains. The mountains run north-south, and the plant site would be east of the approximate

midpoint of the mountain range. The elevation of the tallest peak is approximately 2,755 feet higher than the site.

The Toquop Wash runs from northwest to the southeast, and the South Fork Toquop Wash runs west to east past the plant site. Several other, less significant, drainages also run nearby the site and empty into the Toquop Wash. While these are dramatic physical features of the site, they are of little consequence in air quality considerations.

Alternative 1. The description of physical features for the Alternative 1 plant site is identical to that of the Proposed Action.

Alternative 2. The Alternative 2 power plant would be located approximately 11 miles northwest of the Proposed Action plant site, on the southern end of the Tule Desert. The desert is characterized by relatively level topography, bordered to the east and south by small mountains. This location is approximately 2 miles northwest of the peak of Jumbled Mountain, which rises approximately 800 feet above the site location.

Alternative 3. The description of physical features for the Alternative 3 plant site is identical to that of the Proposed Action.

3.6.1.1.3 Existing Air Quality. With no existing sources of man-made air emissions in the vicinity, the southern and northern plant sites are presumed to have similar existing air quality. All of Lincoln County is in full attainment of ambient air quality standards; that is, existing background concentrations for all criteria air pollutants are less than the maximum allowable ambient concentrations under Nevada and federal regulations. These criteria pollutants include oxides of

nitrogen (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), particulate matter with mean aerometric diameter smaller than 10 microns (PM10), ozone (O₃) which is controlled by regulating the emissions of volatile organic compounds (VOCs) and NO_x, and lead.

Based on guidance from the Nevada Division of Environmental Protection Bureau of Air Quality (NDEP BAQ), the ambient impact analysis assumes that the existing background concentrations of all pollutants, except for PM10, are zero. This is reflective of the lack of existing emission sources in the vicinity. No monitoring data exist to establish more accurate background concentrations; however, given the lack of major transportation corridors or communities in the immediate vicinity of the site, and considering that all permitted air pollution sources in the vicinity were considered in the ambient impact analysis, any actual background concentrations are assumed to be very small compared to the localized, modeled impacts of the proposed facility combined with the other emission sources.

NDEP BAQ estimates that the background concentration of PM10 is up to 10.2 micrograms per cubic meter (ug/m³). While no monitoring for ambient particulate levels has been conducted in the area, NDEP BAQ estimates that windblown dust caused by the hot, arid conditions of the site could reach this level.

Four designated Federal Class I air quality areas exist within 200 kilometers (125 miles) of the Proposed Action power plant site. These include Grand Canyon National Park, which is the nearest at

78 kilometers (49 miles) from the southern Toquop site, and the Sycamore Canyon Wilderness Area, Bryce Canyon National Park, and Zion National Park. The Lake Mead National Recreation Area is a designated Federal Class II air quality area and is approximately 48 kilometers (30 miles) south of the southern Toquop power plant site.

3.6.1.2 Pah Rah Parcel

Washoe County's climate is mild, with low humidity and rainfall. It is characterized as semi-arid to arid with average annual precipitation ranging from 4 to 16 inches. The average annual temperature in Reno is 48°F in the winter and 88°F in the summer.

Portions of Washoe County are currently designated as non-attainment areas in meeting air quality standards for PM10 and CO, and all of Washoe County is designated as a moderate non-attainment area for ozone. The Truckee Meadows Hydrographic Basin (Reno/Sparks urban area) defines the boundaries for the PM10 non-attainment area. The boundaries for the CO non-attainment area are also considered to be the Truckee Meadows Basin. The Pah Rah parcel would be outside of the PM10 and CO non-attainment areas.

3.6.2 Noise

This section addresses existing noise sources and levels in the Toquop and Pah Rah areas. It also describes noise regulations applicable to development on BLM land and in Lincoln and Washoe Counties.

Figure 3-1 (8-1/2 x 11; color) page 1 of 2

Figure 3-1 (8-1/2 x 11; color) page 2 of 2

Noise levels in the Toquop and Pah Rah areas are affected by numerous factors. These factors include: a site's general setting, such as isolated, rural, suburban, or urban; nature of the noise sources or activities occurring in those settings; proximity of the receptor to the noise source or activity; time of day; and various attenuating factors that can mute or interrupt noise waves, such as vegetation, topographic features, buildings, and atmospheric conditions.

Noise levels are measured in units of A-weighted decibels (dBA), which are roughly proportional to loudness as perceived by the average person. Common sound levels covering the full range of human hearing vary from about 10 to 110 dBA. Examples of the variation in noise levels follow: 25 to 35 dBA in rural or remote areas with little human activity; 40 to 50 dBA in a typical office; 50 to 60 dBA in a suburban neighborhood; 60 to 80 dBA along a busy city sidewalk; 80 to 90 dBA from a lawnmower (at the operator); and about 90 dBA from a large truck (at a distance of 50 feet) (USIBWC et al., 2000).

3.6.2.1 Toquop Area

Both the southern plant site and the northern plant site are located within an undeveloped area. Except for the high-voltage transmission lines located near the southern plant site, the dirt road near both the southern and northern plant sites, and the disturbance near the northern plant site from well drilling, no aboveground human-made development exists in the area. The transmission lines emit a hum. No other human-caused noise sources appear to exist in the area, except for overflights of military airplanes (both jet and propeller) and helicopters, which are noisy. The two sites (southern and

northern), located approximately 11 miles and 22 miles, respectively, from I-15, are remote from any urban area.

Typical noise levels in the area are estimated to be between 25 and 50 dBA, depending on the distance from the transmission lines. No residences, schools, or parks (considered sensitive noise receptors) are located in the area.

The Toquop parcels are currently public land under the jurisdiction of the BLM, and are subject to the management guidance included in the Caliente MFP. The Caliente MFP does not contain noise regulations or standards (BLM, 1999).

If either the southern or northern Toquop parcel is exchanged for the Pah Rah parcel, it would be under the jurisdiction of Lincoln County. The Lincoln County Zoning Ordinance does not contain noise regulations or standards (Lincoln County, 2001b).

3.6.2.2 Pah Rah Parcel

The Pah Rah parcel is located within a relatively undeveloped area and no development exists on the Pah Rah parcel. Two 345-kV electric transmission lines are aligned north of the site. A dirt road leads to the transmission lines. I-80 is 1.25 miles south of the parcel. The Union Pacific Railroad tracks are on the south side of I-80. The transmission lines emit a hum that is not audible from the parcel, but the Union Pacific Railroad and I-80 traffic generate noise that is audible from the parcel. South of the site and north of I-80 is a wooden single-pole 60 kV electric transmission line. The Truckee River is on the south side of I-80 and generally parallels the freeway in this area. A mine is located in the mountains south of the Pah Rah parcel on the south side of I-80.

The closest community to this parcel is Wadsworth, several miles to the east.

Typical noise levels within the Pah Rah parcel are estimated to be between 25 and 32 dBA, depending on the location within the site and wind direction. No residences, schools, or parks (considered sensitive noise receptors) are located in the area.

The Pah Rah parcel is currently privately owned land, and is subject to the regulations included in the Washoe County Comprehensive Plan (Washoe Plan). The Washoe Plan does not contain noise regulations or standards (Washoe County, 2000a).

If the parcel is exchanged for either the southern or northern Toquop parcel, it would come under the jurisdiction of the BLM. The BLM's Carson City Field Office Consolidated Resource Management Plan (CRMP) does not contain noise regulations or standards (BLM, 2001a).

3.7 Visual Resources

The existing landscape in the vicinity of the Toquop area and the Pah Rah parcel is described in this section. It also discusses the BLM's Visual Resource Management (VRM) Program.

The BLM has developed a system (the VRM Program) for evaluating the visual resources of a given area to determine what degree of protection, rehabilitation, or enhancement is desirable and possible. The BLM is concerned with managing visual resources equally with other resources and attaining acceptable levels of visual impact without unduly reducing commodity production or limiting overall program effectiveness.

The objective of VRM is to manage public lands in a manner that will protect the quality of the scenic (visual) values of these lands. According to BLM policy, "...visual design considerations shall be incorporated into all surface disturbing projects regardless of size or potential impact. Emphasis shall be placed on providing these inputs during the initial planning and design phase so as to minimize costly redesign and mitigation at later phases of the project design and development..."

Perception of visual quality in a landscape is based on the following common principles:

- Landscape character is determined by four basic visual elements (form, line, color, and texture), which are present in every landscape and exert varying degrees of influence.
- As the influence exerted by these elements increases, the landscape becomes more interesting.
- As the visual variety in a landscape increases, the landscape becomes more aesthetically pleasing. Variety in the landscape without harmony is considered unattractive; landscape alterations that create disharmony are considered unattractive (BLM, 1980).

The objectives for four VRM Classes are the following:

- **Class I Objective.** The objective of this class is to preserve the existing character of the landscape. Natural ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention.

- **Class II Objective.** The objective of this class is to retain the existing character of the landscape. Authorized actions may not modify existing landscapes or attract the attention of casual viewers.
- **Class III Objective.** The objective of this class is to partially retain the existing character of the landscape. Authorized actions may alter the existing landscape, but not to the extent that they attract or focus attention of the casual viewer.
- **Class IV Objective.** The objective of this class is to allow management activities that involve major modification of the existing character of the landscape. Authorized actions may create significant landscape alterations and would be obvious to casual viewers. However, an attempt should be made to lessen the impact of these activities through careful location, reducing landscape disturbance, and repeating the basic elements (form, line, color, and texture).

3.7.1 Toquop Area

Sites of proposed project features in the Toquop area appear as relatively flat land (except where the Toquop Wash would be crossed) that exhibits hues of creams, tans, and grays. Vegetation onsite and along the access road includes species such as Cholla cactus, Mormon tea, galleta grass, Joshua trees, creosote, and white bursage. This vegetation adds texture and contrast, and provides some visual interest to the relatively level landscape. The southern and northern Toquop parcels appear undeveloped except where three high-voltage transmission lines cross a corner of the southern parcel.

The East Mormon Mountains to the west are clearly visible from the southern plant site. Beyond the East Mormon Mountains, the Mormon Mountains (approximately 5.5 miles west of the southern Toquop parcel) and the Mormon Mountains Wilderness Study Area (3.75 miles west of the southern Toquop parcel) are visible from the southern Toquop parcel. The East Mormon Mountains are at approximate elevation 4000 feet in this area and the Mormon Mountains range from elevations 4200 to 5200 feet. However, further south, the East Mormon Mountains are taller and obstruct views of the Mormon Mountains from the southern plant site. The East Mormon Mountains would also obstruct views of the plant site from the south end of the Mormon Mountains.

Neither the southern or northern Toquop parcel is visible from I-15.

The BLM Las Vegas office currently manages the land that includes the southernmost 5 miles of the project access road (from I-15 north to the Clark County/Lincoln County boundary) as VRM Class III. The BLM Ely office currently manages the land that includes the southern and northern Toquop parcels, transmission line, water pipeline, natural gas connection, wellfield, and the access road from the Clark County/Lincoln County boundary north to the two project sites as VRM Class IV.

3.7.2 Pah Rah Parcel

The Pah Rah parcel consists of steep-sided mountain slopes. No roads, transmission lines, or other human-made development exist on the site. Section survey markers are present, but are not apparent to the untrained eye. Vegetation consists of low-lying desert vegetation common to the area. Loose dark-colored rock is present

along the hillsides and provides a contrast to the lighter-colored slopes. An undeveloped hiking trail along the west side of the slope exists, but is not noticeable from a distance. No recreational or other hiking trails exist on the Pah Rah parcel, although numerous game trails lead to the parcel and cattle paths exist below it. The undeveloped nature of the parcel reflects the natural character of the mountains in the area. In views of the parcel from the north, the colors represented are tans, creams, and warm browns. Low-lying desert vegetation is visible, as is loose rock on the slopes.

Two 345-kV transmission line corridors exist to the north of the parcel. A mine exists to the south on the south side of I-80. I-80 is approximately 1.25 miles south of the parcel and is visible from the southern edge of the top of the mesa.

Views from the top of the Pah Rah parcel include the cement plant in Fernley to the east, the diatomite mine and associated mining scars in the mountains to the south, I-80 to the south, the Truckee River on the south side of I-80, and the Union Pacific Railroad tracks, also on the south side of I-80. Views to the north are of other mountains, the Olinghouse Mine and its heap leach area, open space (undeveloped land), and the two 345-kV transmission line corridors.

The nearest freeway offramp to the Pah Rah parcel is the Derby Dam exit, approximately 1.5 miles southwest of the site. From this viewpoint looking north, the parcel appears undisturbed. From the south, the slopes of the parcel are shades of pinks, grays, and dark brown. No vegetation appears visible, and no shades of green are visible.

The Pah Rah parcel is privately owned land; however, the BLM has classified the area that includes the Pah Rah parcel according to its VRM Program. Roughly the northwest quarter of the Pah Rah parcel is designated VRM Class IV, and the remainder of the parcel is designated VRM Class III. Class IV lands surround the parcel to the north, northwest, and west. Class III lands surround the parcel to the northeast, east, southeast, south, and southwest (BLM, 2001a).

3.8 Recreation Resources

This section describes existing recreation resources in the vicinity of the Toquop area and Pah Rah parcel.

3.8.1 Toquop Area

The Toquop area is relatively remote. Traditional use of the area has been by small game bird (quail) and big game hunters during identified seasons. Several bird guzzlers and springs are present west of the area in the East Mormon Mountains. Hunting and trapping of fur bearers also occurs in the area. Seasonal wildflower sighting, bird watching, and primitive camping are springtime recreational activities.

The southern and northern Toquop parcels are approximately 15 miles from the Logandale Trails System, a multiple use motorized and non-motorized trails play area. The parcels are also approximately 20 miles north of the north arm of Lake Mead. The closest recreation area is Overton Beach on the north arm of the lake. Lake Mead is part of the Lake Mead National Recreation Area, which encompasses Lake Mead, Lake Mohave, and both federal and non-federal land.

The popularity of special use vehicles over the last 20 years has encouraged casual 4-wheel drive exploration of primitive and remote public land areas. The Toquop Wash is used by OHVs year-round and by quail hunters in the fall. OHV use in the Toquop area has been increasing over the years. Several high-speed competitive OHV events have occurred in the area since the late 1970s, including small truck/car races conducted by the Silverdust Racing Association, the ACERBIS Nevada Rally for motorcycles, several Best in the Desert Racing Association truck/car/motorcycle/ATV events, and the Nevada 2000 OHV race.

In addition, non-speed, non-competitive, street-legal, off-highway-capable, self-guided motorcycle scenic touring is a popular venue in back country areas. The Caliente/Tule Desert/Mormon Mountains area is used for several self-guided motorcycle scenic tours.

Because of the rapid urban expansion of Las Vegas and Clark County and the resultant loss of traditional OHV competitive areas, and air quality management issues, the BLM Las Vegas Field Office expects that areas such as the Tule Desert could potentially be used for competitive and organized OHV events in the future (Bruno, 2002).

3.8.2 Pah Rah Parcel

The Pah Rah parcel is relatively remote. The remote nature of the parcel and its private ownership limits the amount of recreation opportunities available to the public. Its remoteness, particularly the lack of direct vehicular access and its steep terrain, probably are the overriding reasons for the lack of recreational use.

The Pah Rah parcel is approximately 13 miles south of Pyramid Lake and 2 miles north of the Truckee River. Pyramid Lake lies within the Pyramid Lake Reservation (Tribal lands). A hot spring exists there. Fishing also occurs at Pyramid Lake. Tours are given at the fish hatcheries. A marina and a visitor center with a store are located at the lake.

Picnicking, fishing, and rafting occur at various locations along the Truckee River. Opportunities for recreational trails are limited in the Truckee Canyon planning area because of its steep terrain and remote location (Washoe County, 2000b).

3.9 Land Use, Prime or Unique Farmlands, and Rangelands

3.9.1 Toquop Area

3.9.1.1 Existing Land Use and Land Ownership

3.9.1.1.1 Project Site Land Use and Ownership. The Toquop area is public land administered by the BLM. The southern Toquop parcel is within Assessor Parcel Number (APN) 08-251-01. This parcel is described as Section 36, T11S, R69E in Lincoln County, Nevada. The southern Toquop parcel is currently uninhabited, with development restricted to a series of dirt roads and utility corridors. Properties immediately adjoining the southern Toquop parcel are also administered by the BLM.

A title report was prepared for the area generally covered by: 1) the access road from I-15 north to the southern Toquop parcel; 2) the southern Toquop parcel; 3) the western pipeline alignment; 4) the northern Toquop parcel; 5) the majority of the wellfield area; and 6) the northern half

of the eastern pipeline alignment (Stewart Title of Northern Nevada, 2001).

Table 3-4 lists the existing easements and rights-of-way identified.

3.9.1.1.2 Transportation and Urban

Uses. The transportation corridor closest

to the Toquop parcels is I-15, located approximately 11 miles from the site of the Proposed Action. I-15 is a major highway that passes through Las Vegas and connects Salt Lake City to Los Angeles. An unimproved dirt road leads to the southern and northern Toquop parcels from I-15.

TABLE 3-4
Easements and Rights-of-Way in the Toquop Area

Affected Project Location	Easement/Right-of-Way
Southern Toquop parcel	Easements and rights-of-way for power transmission lines, oil and gas pipelines, oil and gas facilities, fiber optic facilities, and incidental purposes
Access road from southern Toquop parcel south to Clark County border	Easements and rights-of-way for power transmission lines, oil and gas pipelines, oil and gas facilities, fiber optic facilities, coal slurry pipeline, telephone and telegraph line and facilities, communication site, radio repeater site, microwave radio relay site, water gauge system (rain gauge), access road, and incidental purposes
Access road from Clark County border south to I-15	Easements and rights-of-way for highway, communication site, microwave radio relay site, underground phone line, vortac site, material sites, access road, and incidental purposes, and protective easement
	Matters relating to an airport lease in favor of the Federal Aviation Administration
	Matters relating to a land conveyance in favor of the City of Mesquite
	Easements and rights-of-way for wind monitors on Flat Top and Mormon mesas and incidental purposes
Northern Toquop parcel	Easements and rights-of-way for water facility and incidental purposes
Northern portion of eastern pipeline alignment	Unrecorded easements and rights-of-way for water facility and incidental purposes
Western pipeline alignment	Easements and rights-of-way for water facility and incidental purposes
Wellfield area	Easements and rights-of-way for water facility and incidental purposes
Southern Toquop parcel	Terms, conditions, restrictions, covenants, and provisions of proposed land exchange
All Toquop project areas except wellfield area	Terms, conditions, restrictions, covenants, and provisions set forth in application dated June 15, 2001, filed by Toquop Energy, Inc., and Lincoln County, Nevada, with BLM
Areas along Kern River Gas Pipeline affected by project features	Terms, conditions, restrictions, covenants, and provisions as set forth in "Construction, Operating and Maintenance Agreement" dated July 17, 1998, between Kern River Gas Transmission, a Texas General Partnership, and Williams Communications, Inc. a Delaware Corporation, recorded February 25, 1999

Source: Stewart Title of Northern Nevada (2001).

The urban center nearest the Toquop parcels is the City of Mesquite, approximately 12 miles to the southeast. Other than electrical transmission, fiber optic communication, and natural gas lines, no residential, commercial, or industrial land uses are located within or adjacent to the two Toquop parcels.

3.9.1.1.3 Mining Uses. BLM's databases contain no records of mining claims, mineral leases, or mineral rights-of-way within the project area. Patented and unpatented claims for gypsum have occurred offsite, approximately 0.5 mile to 7 miles away.

Current exploration activities include several small barite veins that were prospected about 4.5 miles northwest of the southern power plant site.

The Snowwhite gypsum deposit occurs about 2 miles north of the southern power plant site on the northeast side of the Toquop Wash. Additional recent exploration for gypsum has occurred 4 miles southwest of the southern power plant site.

Exploration for minerals continues in the area—primarily for gypsum. The potential for minerals supports continued exploration. However, the current development potential for these mineral resources is low based on the availability of sources closer to economic centers and prices.

3.9.1.2 Designated Land Use

BLM-designated land uses in the project area include grazing allotments, ACECs, WSAs, and critical habitat. These land uses are described in the appropriate sections of this *Proposed Land Disposal Amendment to the Caliente MFP and*

Final Environmental Impact Statement for the Toquop Energy Project.

The Toquop area is designated “A-5” (agriculture with a 5-acre minimum) according to Lincoln County. The “A” agricultural district is established for areas particularly suited for raising crops and animals and other related agricultural activities. Permitted uses include those related to agricultural uses. Uses subject to special use permit include agricultural industries; dumps; forest industries; golf courses; livestock feed yards; recreational resorts; and public utility or public service buildings, structures, and uses (Lincoln County, 1990).

3.9.1.3 Prime or Unique Farmlands

Prime farmland, as defined by the U.S. Department of Agriculture, is that land best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high crop yields if acceptable farming methods are used. Prime farmland produces the highest yields with minimal inputs of energy and money, and farming it results in the least damage to the environment. Prime farmland is either currently used for producing food or fiber or is available for this use. Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods or frequently flooded during the growing season. The slope ranges mainly from zero to 6 percent (NRCS, 1990).

Approximately 94,400 acres (nearly 3.5 percent of Lincoln County [south part] soil survey area) would meet the

requirements for prime farmland if an adequate and dependable supply of irrigation water were available and the soils were reclaimed to reduce salinity and alkalinity. None of the soil map units on the Toquop parcels meet the soil requirements for prime farmland (NRCS, 1990).

The Virgin River area soil survey area, which includes the access road from I-15 heading north for roughly half the distance to the southern Toquop parcel (8 miles), is not prime farmland (NRCS, 1970).

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil qualities, location, growing season, and moisture supply needed for the economic production of sustained high yields of a specific high-quality crop when treated and managed by acceptable farming methods. Unique farmland is used for a specific high-value food or fiber crop; has an adequate supply of available moisture for the specific crop because of stored moisture, precipitation, or irrigation; and has a combination of soil qualities, growing season, temperature, humidity, air drainage, elevation, aspect, and other factors, such as nearness to markets, that favor the production of a specific food or fiber crop. No soils in Nevada are currently recognized as unique farmland (NRCS, 1990).

3.9.1.4 Rangelands

Rangeland provides many important resource values: it acts as a vast watershed and provides habitat for wildlife, livestock forage, and opportunities for recreation. The resource values of rangeland are intricately interrelated and are often directly affected by rangeland management. Proper management of

rangeland depends on many factors: the season of grazing use, the species of grazing animal, the intensity and distribution of grazing, and the range resource potential (NRCS, 1990).

Approximately 98 percent of the acreage in the Lincoln County, Nevada, South Part, soil survey area is rangeland. This survey area includes the southern and northern Toquop parcels, the alignments, the wellfield, and the access road from the southern Toquop parcel heading south for approximately 7 miles. All of the wellfield/pipeline are located within portions of the White Rock (2,880 animal unit months [AUMs]), Garden Springs (2,809 AUMs), Summit Spring (715 AUMs), Snow Springs (3,567 AUMs), or Gourd Spring (3,458 AUMs) grazing allotments (see Maps 3-10, 3-11, and 3-12 for the Proposed Action and Alternative 3, Alternative 1, and Alternative 2, respectively). The allotments are shown for each alternative. These allotments are utilized during the fall, winter, and spring. The southern parcel lies within the Gourd Spring Allotment. This parcel has been removed from livestock management because of the Gourd Springs ACEC boundary fence. The northern parcel lies within the southern portion of the Garden Springs Allotment. Livestock grazing is the principal agricultural use of the rangeland (NRCS, 1990).

An Environmental Assessment (EA) was recently prepared that addressed the Gourd Springs ACEC boundary fence. The fence was completed in December 2001. It is located along the western section line of Section 36, T11S, R69E (the southern Toquop parcel). The purpose of the fence is to restrict livestock from entering the Mormon Mesa ACEC, which is closed to livestock (BLM, 2001b).

Map 3-10 (11 x 17; color) page 1 of 2)

Map 3-10 (11 x 17; color) page 2 of 2)

Map 3-11 (11 x 17; color) page 1 of 2)

Map 3-11 (11 x 17; color) page 2 of 2)

Map 3-12 (11 x 17; color) page 1 of 2)

Map 3-12 (11 x 17; color) page 2 of 2)

Most of the acreage in the Virgin River soil survey area, which includes the access road from I-15 heading north for roughly half the distance to the southern Toquop parcel (8 miles), is rangeland. This area lies within the Mormon Mesa Allotment administered by the Las Vegas Field Office. The Mormon Mesa Allotment has been closed to livestock management because of the Record of Decision for the Management of Desert Tortoise Habitat EIS.

3.9.2 Pah Rah Parcel

3.9.2.1 Existing Land Use and Land Ownership

3.9.2.1.1 Project Site Land Use and Ownership. The Pah Rah parcel is owned by Nevada Land and Resource Company, LLC (NLRC) (see Map 3-13). The parcel is APN 84-040-12, described as Section 9, T20N, R23E in Washoe County, Nevada. The Pah Rah parcel sits atop a mesa that is uninhabited. No activity on the parcel is visible other than the placement of survey markers. Properties immediately adjoining the Pah Rah parcel to the north, east, south, and west are administered by the BLM. Properties adjoining the Pah Rah parcel to the northwest, northeast, and southeast are owned by NLRC. No roads, rights-of-way, or easements are known to occur on the Pah Rah parcel. Road rights-of-way are located west, northwest, and north of the parcel, and pipeline rights-of-way are located south of the parcel. High-voltage electric transmission lines are located north and south of the parcel.

3.9.2.1.2 Transportation and Urban Uses. The transportation corridor closest to the Pah Rah parcel is I-80, located approximately 1.25 miles south of the parcel. I-80 is a major east-west interstate

freeway. An unimproved dirt road leads to within 0.25 mile of the northwest corner of the Pah Rah parcel from State Route 447 (SR 447), which intersects I-80 near Wadsworth, Nevada.

The urban center nearest the Pah Rah parcel is the Pyramid Lake Indian Reservation community of Wadsworth, 5.5 miles to the east. No residential or commercial land uses are located in the vicinity of the Pah Rah parcel. An industrial use (a gold and silver mine) exists approximately 2 miles north, and another mine (diatomite) exists approximately 3 miles south of the Pah Rah parcel on the south side of I-80. The Union Pacific Railroad also maintains an active railroad line that generally parallels I-80 and the Truckee River near the Pah Rah parcel.

3.9.2.1.3 Mining Uses. Because the parcel is privately owned land, it has not been available for mining by the public. There are no records or evidence of past prospecting activity on the Pah Rah parcel. No gold or other economic mineral occurrences have been identified on the Pah Rah parcel.

The most important industrial minerals found near the Pah Rah parcel are gold and silver, limestone for cement manufacturing, and diatomite. Cement manufacturing also requires small amounts of clay and gypsum which are obtained locally. Aggregates such as sand, gravel, pumice, and minor perlite have been mined west of the Pah Rah parcel, near Reno, and to the east near Fernley, Nevada (BLM, 2001f).

3.9.2.2 Designated Land Use

The Pah Rah parcel is zoned A-11 (Agricultural Deferred). Agricultural

zoning refers to onsite production of plant and animal products by agricultural methods, including agricultural processing, sales, and production; animal slaughtering; crop production; forest products; game farms; and produce sales (Washoe County, 2000c).

The Pah Rah parcel is located within a grazing allotment area identified by the BLM (2001a).

3.9.2.3 Prime or Unique Farmlands

The definition of prime farmland in Washoe County is similar to that for Lincoln County except that the slope ranges mainly from zero to 4 percent in Washoe County (south part) (NRCS, 1979). About 30,000 acres (3 percent of Washoe County [south part] soil survey area) meets the soil requirements for prime farmland provided that adequate irrigation water is available. None of the soil map units on the Pah Rah parcel meet the soil requirements for prime farmland (NRCS, 1979).

No soils are currently recognized as unique farmland in Nevada (NRCS, 1990).

3.9.2.4 Rangelands

The objective in range management is to manage grazing so that the plants growing on a site are approximately the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources (NRCS, 1979).

The soils within the Pah Rah parcel, (the Oppio-Rezave-Rock outcrop association, Osobb, Rezave-Fireball association, and Bombadil-Hefed-Rubble land association) are used as, or are suitable for, rangeland (NRCS, 1979).

The Pah Rah parcel lies within the Olinghouse Grazing Allotment, with 696 AUMs. Grazing utilization levels are maintained at 55 percent or less to preserve the existing ecological condition and trends. An annual allowance of 182 AUMs exists within this allotment to maintain existing mule deer habitat. No evidence of grazing was observed on the parcel during the spring field reconnaissance (BLM, 2001b).

3.10 Wilderness Study Areas, Areas of Critical Environmental Concern, and Wild and Scenic Rivers

3.10.1 Toquop Area

3.10.1.1 Wilderness Study Areas

The Proposed Action and all alternatives do not lie within a Wilderness Area, Wilderness Study Area (WSA), or Instant Study Area (ISA). Three WSAs are located north and west of the proposed locations of project features associated with the Toquop Energy Project. These include the Clover Mountains WSA (NV-050-139), the Meadow Valley Range WSA (NV-050-156), and the Mormon Mountains WSA (NV-050-161). Portions of all three WSAs have been recommended as suitable for wilderness designation by the BLM (BLM, 1991).

Map 3-13 (8-1/2 x 11; color) page 1 of 2

Map 3-13 (8-1/2 x 11; color) page 2 of 2

The Mormon Mountains WSA is closest to the southern Toquop parcel. This 162,886-acre WSA is 3.75 miles west of the southern parcel. The western water pipeline alignment is approximately 1 mile east of the Mormon Mountains WSA. The northern Toquop parcel is approximately 5 miles east of the Mormon Mountains WSA. The potential wellfield abuts the Mormon Mountains WSA. Maps 3-14, 3-15, and 3-16 show lands in the project area that have been designated as WSAs and Areas of Critical Environmental Concern (discussed in Section 3.10.1.2), and locations of project features for the Proposed Action and Alternative 3, Alternative 1, and Alternative 2, respectively.

The BLM conducted a statewide wilderness inventory in 1979 and 1980. In that inventory, the Tule Desert (NV-050-01R-29), Lime Mountain (NV-050-0159), Tule Springs Hills (NV-050-0180), Hollow Wash (NV-050-01R-30), and Lone Mesa (NV-050-210) units were inventoried and dropped from further consideration as wilderness. According to the inventory report, the Tule Desert Unit included, "...a highway, paved roads, reservoirs, structures and communication sites (which) divide the area into parcels of less than 5, 000 acres each and clearly leave the unit in an unnatural condition..." The report also stated that the area had little topographic screening and did not have outstanding opportunities for recreation. The Lime Mountain Inventory Unit (NV-050-0159) was dropped from further consideration as wilderness because the area did not have an outstanding opportunity for solitude because of insufficient vegetative screening. In addition, recreation opportunities in the area were not found to be outstanding. The Tule Springs Hills Unit was dropped because the area had

been impacted by numerous mining claims and scars, roads and ways, pipelines, and water tanks found throughout the entire unit. In addition, the unit lacked sufficient vegetative screening to adequately screen the intrusions found within the unit. The Tule Springs Hills Unit provides recreation opportunities; however, "...other areas in the vicinity offer higher quality recreation experiences." The Hollow Wash Unit was dropped from further consideration because it lacked vegetative screening and did not offer outstanding opportunities for solitude and for primitive and unconfined recreation. The Lone Mesa Unit was dropped from consideration because it lacked both naturalness and outstanding opportunities for primitive and unconfined recreation. (BLM, 1979).

3.10.1.2 Areas of Critical Environmental Concern

The Federal Land Policy Management Act of 1976 (FLPMA) requires that priority be given to the designation and protection of ACECs. An ACEC designation is the principal BLM designation for public lands where special management is required to protect important natural, cultural, and scenic resources, or to identify natural hazards.

Special Management Areas (SMAs) for desert tortoise were proposed as three ACECs by BLM in its 1999 *Proposed Caliente Management Framework Plan Amendment* (MFPA) and *Final Environmental Impact Statement for the Management of Desert Tortoise Habitat*. The three ACECs are: Kane Springs, Mormon Mesa, and Beaver Dam Slope (BLM, 1999). The Mormon Mesa and Beaver Dam Slope ACECs are located nearest to the two Toquop parcels and alignments. The Kane Springs ACEC is

approximately 28 to 35 miles west of the two Toquop parcels and alignments. Maps 3-10, 3-11, and 3-12 show lands in the project area that have been designated as ACECs.

The southern Toquop parcel is not located within the Mormon Mesa ACEC, but borders it. Except for the northernmost 0.9 mile, the 14.4-mile-long access road to that parcel from the south is within the Mormon Mesa ACEC. That portion of the access road in the Mormon Mesa ACEC consists of 5.2 miles in Clark County and 8.3 miles in Lincoln County. The Las Vegas Field Office of the BLM is responsible for administering ACEC resource constraints in the Clark County portion, while the Ely Field Office of the BLM is responsible for the Lincoln County portion. The access road and eastern and western utility alignments (associated with the Proposed Action and three action alternatives) between the southern and northern Toquop parcels are not located within an ACEC. The Beaver Dam ACEC is approximately 0.25 to 0.5 mile east of the eastern alignments, depending on location along the alignment. The access road between the northern and southern parcels, and the eastern and western utility alignments, are located within tortoise habitat (BLM, 2001d). However, a 3.5-mile portion of the access road for Alternative 2 and a 0.5-mile portion of the utility alignment for Alternative 2 are located in FWS “critical” habitat for the desert tortoise.

The MFPA indicates that management plans would be prepared for the ACECs. The plans would include land management prescriptions with the intent of recovering the Mojave population of the desert tortoise. Management directions for the ACECs address such issues as vegetation, wildlife, grazing, wild horses, and land

disposal and withdrawals. The management direction applicable to the proposed project is to grant access roads to private parcels, federal oil and gas leases, and mining claims based on NEPA analysis and Section 7 consultation.

Management direction is also proposed for desert tortoise habitat outside of the ACECs to improve that habitat and be consistent with the recovery efforts by other agencies (BLM, 1999). The FWS-designated “critical” habitat area will be adjusted to reflect BLM’s ACEC areas when all applicable (all states’) land use plans for desert tortoise habitat have been amended.

3.10.1.3 Wild and Scenic Rivers

On October 2, 1968, Congress created the National Wild and Scenic Rivers System. The Wild and Scenic Rivers Act (P.L. 90-542, as amended) provided for a National Wild and Scenic Rivers System, designated the initial components of that system, and prescribed methods by which, and standards according to which, additional river components may be added to the system. Rivers are either authorized for listing as wild, scenic, or recreational by an Act of Congress or are designated by an act of the legislature of the state or states through which they flow. Nevada does not have any rivers that are listed pursuant to the National Wild and Scenic Rivers System (NPS, 2001a). As of 1998, no rivers in Nevada had been designated for study (NPS, 2001b).

3.10.2 Pah Rah Parcel

3.10.2.1 Wilderness Study Areas

No Wilderness Areas or WSAs exist near the Pah Rah parcel.

Map 14 (11 x 17; color) page 1 of 2

Map 14 (11 x 17; color) page 2 of 2

Map 15 (11 x 17; color) page 1 of 2

Map 15 (11 x 17; color) page 2 of 2

Map 16 (11 x 17; color) page 1 of 2

Map 16 (11 x 17; color) page 2 of 2

3.10.2.2 Areas of Critical Environmental Concern

The BLM Carson City Field Office Consolidated Resource Management Plan (CRMP) (BLM, 2001a) identified the following three ACECs within its planning area: the Incandescent Rocks Natural Scenic Area, the Steamboat Hot Springs Buckwheat Area, and the Stewart Valley Natural Research Area. The designation for the proposed Soda Lake ACEC was abandoned because of insufficient public lands. In 2001, the Southern Washoe County Urban Interface Plan Amendment identified the following three additional ACECs: the Carson Wandering Skipper Area, the Pah Rah High Basin (Dry Lakes) Petroglyph District, and the Virginia Range Williams Combleaf Habitat Area. The Pah Rah parcel is located approximately 9.5 miles east of the Pah Rah High Basin (Dry Lakes) Petroglyph District ACEC (BLM, 2001a).

3.10.2.3 Wild and Scenic Rivers

As discussed above, no rivers in Nevada are listed pursuant to the National Wild and Scenic Rivers System (NPS, 2001a), and, as of 1998, no rivers in Nevada had been designated for study (NPS, 2001b).

3.11 Wastes, Hazardous and Solid

This section discusses solid and hazardous wastes as they relate to the Proposed Action and the alternatives. Sites with known or suspected waste releases may be affected by a proposed project. Therefore, the Toquop area and Pah Rah parcel were evaluated to assess environmental conditions relative to the presence of solid or hazardous wastes. No solid or hazardous wastes are currently being

generated within the Toquop area or the Pah Rah parcel, and no historic solid or hazardous waste sites were identified for these areas.

3.11.1 Toquop Area

A Phase I Environmental Site Assessment of the southern Toquop project area was prepared (Resource Concepts, Inc., 2001b). The investigation included the following activities:

- Review of ownership records and maps
- Review of site natural history
- Interviews with current owner's representative
- Review of federal, state, local, and additional environmental regulatory records
- Site reconnaissance

The southern Toquop parcel is currently uninhabited; development is limited to a series of dirt roads and five utility corridors (easements). The primary road generally follows the utility corridor. A secondary road departs from the utility corridor just southwest of the property, passes through the west and north portions of the parcel, and joins with the utility corridor road just outside of the northeast corner of the Toquop parcel. The utility easements that traverse the Toquop parcel include three transmission lines, a buried natural gas line, and a buried fiber optic cable. The Gourd Springs Mining District is located west and north of the Toquop parcel.

The environmental site assessment also included the results of a search of EPA's

Envirofacts database to determine whether the southern or northern Toquop parcels, or any properties within a 1-mile radius including utility corridors and the wellfield, have had chemical releases, water discharges, hazardous waste handling operations, or are sites with Superfund status. In addition, State records from the NDEP and local records from the Mesquite Fire and Rescue Department were reviewed. No issues of concern related to hazardous or solid waste were identified for the Toquop project area.

3.11.2 Pah Rah Parcel

A Phase I Environmental Site Assessment of the Pah Rah parcel was prepared (Resource Concepts, Inc., 2001c). The environmental site assessment included the same investigative activities as described for the Toquop area.

The Pah Rah parcel is APN 84-040-12, described as Section 9, T20N, R23E. The parcel is located atop a mesa at the southern end of the Pah Rah mountain range in Washoe County, Nevada. The parcel is uninhabited, with no development other than minor activity related to surveying. Virtually no improvements exist on the Pah Rah parcel other than survey markers. Small amounts of airborne litter were found at various locations on top of the mesa.

A transmission line corridor runs from the southwest to the northeast along the canyon west and north of the Pah Rah parcel. North of the parcel are a series of dirt roads, two transmission lines, and Olinghouse Mine. An old railroad grade extends between Wadsworth (east of the property) and Olinghouse Mine (northeast of the property). To the south, between the parcel and the Truckee River, are a buried

pipeline, a transmission line, I-80, and a railroad corridor.

No issues of concern related to hazardous or solid waste were identified.

3.12 Cultural and Historical Resources and Native American Religious Concerns

3.12.1 Toquop Area

The Toquop area is in the Mojave Desert where humans have lived for approximately 12,000 years, mostly as mobile hunter-gatherers (Lyneis, 1982; Willeg and Aikens, 1988). Early Paleoindian groups focused more heavily on large game than later Archaic peoples who put greater emphasis on plant resources, as evidenced by an increasing profusion of, and sophistication in, ground-stone technology through time. The archaeological record indicates that over the past 8,000 years, increasing Archaic population density in the Great Basin pressured people into more restricted mobility, diverse diet breadth, and rigorous seasonal resource scheduling (Fowler and Madsen, 1986).

Virgin River and Muddy River Anasazi settlements, which developed approximately 300 A.D., broke from the strict hunter-gatherer lifeway typical of the rest of the Great Basin (Fowler and Madsen, 1986). These groups were more sedentary, living in pit-houses overlooking horticultural fields near the rivers. Still, use of surrounding lands, such as the Toquop Wash area, probably remained similar to that of earlier groups, even if less intensive. At approximately 1,000 to 1,200 years ago, a rapid population decline occurred in the area and, again, hunter-gatherer groups occupied the area.

Considerable debate exists as to the nature of this shift and whether it represents a simple change in settlement-subsistence pattern (a byproduct of climatic change), or replacement of Anasazi peoples by Numic-speaking groups expanding from the southeast California area (Fowler and Madsen, 1986; Madsen and Rhode, 1994). By the ethnographic present, the project area was inhabited by the Southern Paiute, but closely neighbors Mohave and Walapai lands to the south and Shoshone territory to the northwest.

The generally rugged terrain and lack of mineral resources has resulted in little historical use of the project vicinity (Sterner and Ezzo, 1996; White et al., 1991). Transportation has typically followed the more amenable landscape through the Virgin Valley, and mining interests have been limited to small-scale operations in surrounding areas. Mormon interest in the region began in the mid-nineteenth century, particularly in the Virgin River and Muddy River valleys where farming and ranching were possible. Springs, such as Abe Spring and Tule Spring located near the proposed eastern pipeline alignment, were used historically as watering holes for cattle.

Cultural resources work was conducted to comply with Federal law as required by the National Historic Preservation Act (NHPA) of 1966, as amended through 2000, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, and the American Indian Religious Freedom Act (AIRFA) of 1978. Cultural resource permits required for the proposed project consist of a BLM Cultural Resource Use Permit, and a Nevada state curation agreement.

All cultural resources work was carried out according to the stipulations of a

Programmatic Agreement (contained in *Appendix C, Cultural Resources Programmatic Agreement*) between the BLM, SHPO, and Toquop Energy for the Toquop Energy Project regarding the identification and treatment of historic properties. A Class III inventory, as defined in the BLM's (1990) cultural resource guidelines, was conducted for the linear portions of the Proposed Action and alternative project features to identify cultural resources. After prior consultation with, and concurrence of Nevada SHPO, Class II inventories were conducted for both the southern power plant site (for the Proposed Action, Alternative 1, and Alternative 3) and the northern alternative site (for Alternative 2). A Class I literature review and site files search was conducted for the wellfield area at the Harry Reid Center for Environmental Studies; specific well locations within this area will be inventoried at the Class III level once their final location and access routes are determined.

Thirty-four cultural resources sites and 10 isolated artifacts are known within the 1-mile study radius designated for review, although most are outside the ROWs. These are summarized in Table 3-5. Prehistoric sites include flaked stone scatters, roasting pits, rockshelters, and rock alignments in addition to isolated artifacts. Historic period sites include one pioneer burial, a telephone line, roads, and debris deposits, in addition to isolates. Some sites contain prehistoric and historic components. Thirty-six archaeological reports on previous work in the project vicinity were consulted during literature review. Further details regarding the sites and relevant literature will be contained in the pending stand-alone archaeological report, BLM report number NV-04-02-1376b.

TABLE 3-5

Archaeological Sites and Isolated Artifacts within 1 Mile of the Proposed Action and Alternatives

Category	NRHP* Eligible	Not NRHP Eligible
Prehistoric	7	19
Historic	3	2
Prehistoric/Historic	0	3
Isolate	0	10

*NRHP=National Register of Historic Places

Information relating to Native American concerns comes from two sources: existing ethnographic reports and data collection resulting from both the earlier land exchange proposal (the southern power plant site of the Proposed Action now incorporated as part of the Toquop Energy Project) and data collection done in relation to the Toquop Energy Project specifically. The BLM has initiated consultation with the following Paiute Indian Tribes: the Moapa Band of Paiutes (Nevada), the Paiute Indian Tribe of Utah, the Shivwits Band (Utah), the Las Vegas Paiute Tribe (Nevada), and the Kaibab Paiute Tribe (Arizona)—and informed one other tribal member as requested by the Paiute Indian Tribe of Utah of the proposed land exchange involving the Toquop parcel. The Moapa Band of Paiutes, Shivwits Band (Utah), and the Paiute Indian Tribe of Utah responded. The Las Vegas Paiute Tribe declined involvement, and no other responses were received. The responding tribes made on-site visits. All expressed concern that a property of traditional cultural or religious importance, the Salt Song Trail, might be affected, and the Moapa Band identified the trail as a sacred site. No “Indian plants” were mentioned or identified. Two tribes expressed concern for preservation of the archaeological resources. Subsequent data gathering has resulted in

expressions of no concern for the Toquop Energy Project from both the Paiute Tribe of Utah and the Las Vegas Paiute Tribe. The Shivwits Band retains its concern for the preservation of all prehistoric archaeological resources; they indicated that its tribal members do not believe the Salt Song Trail extended into the project area after making a field visit to the area. Efforts continue to obtain information from the Moapa Band of Paiutes and from the Kaibab Paiute Tribe regarding the Toquop Energy Project.

Ethnographic information includes comments from Indian tribes and individuals (Stoffle et al., 1983) made in relation to construction of one of the existing electrical transmission lines that pass through the southern power plant site alternative. Various property types were established and then ranked by Indian participants as to their degree of concern for preservation of the property type. For example, trails were ranked ninth among eleven categories, although the level of concern was relatively high across all categories; the Salt Song Trail is not mentioned specifically by Stoffle et al. (1983).

Several geographic features were ranked by Indian participants as to their levels of concern; those relevant to the project area are the Toquop Wash, Tule Springs Hills,

Halfway Wash, Davidson Peak, and the East Mormon Mountains. Stoffle et al. (1983:91) state that “meanings” are attached to the named places, but those meanings are neither identified specifically nor amplified. One other place contained rockshelters, possibly other physical features, as well as various plants that were of concern to Native Americans (Stoffle et al., 1983:Tables 43, 44). Mitigation was suggested in several forms, including presence of a representative of the Moapa Band of Paiutes during groundbreaking activity, and consultation with Indian tribes concerning archaeological sites and “disposition of stands of Indian plants” (Stoffle et al., 1983:183).

No rockshelters or prehistoric or ethnohistoric archaeological sites were identified during the cultural resources inventory in this area of concern to Native Americans. No tribe has provided information as to a definite location of the Salt Song Trail relative to the Proposed Action or alternatives, or as to how religious practitioners would be affected by these actions. As noted previously, at least one tribe does not think the Salt Song Trail extends into the area of the Toquop Energy Project, and two others have expressed no concerns for the proposals.

3.12.2 Pah Rah Parcel

The general description of the cultural background for the Toquop area also applies to the Pah Rah parcel. However, by the ethnographic present, the Pah Rah parcel was within an area inhabited by the

Northern Paiute, but closely neighbors traditional Washoe lands to the west.

The Pah Rah parcel is near the Truckee River and the Truckee Meadows, which were central to historic mining and logging transportation. A major east-west travelway leading west to nearby Reno, Nevada, has been in place since the mid-nineteenth century.

A Class II inventory, as defined in the State Protocol Agreement between the BLM and Nevada SHPO, was conducted for the Pah Rah parcel to identify cultural resources and assess cultural resource value. Consultation with Native American Tribes has been completed. The BLM consulted with the Pyramid Lake Paiute Tribe, the Washoe Tribe of Nevada and California, and the Reno-Sparks Indian Colony regarding the proposed land exchange and the Pah Rah parcel. No concerns were identified.

The Class II inventory and site file search identified several archaeological sites and a number of isolated artifacts or features (Table 3-6). Site types include rock features (most without associated artifacts) and an historic debris scatter. One site is NRHP eligible, while most are unevaluated. Most of these sites will require subsurface excavation to complete assessment, and one requires further consultation with appropriate Indian tribes to complete evaluation. One historic period site was determined not eligible due to its ambiguity of historic context. None of the isolates are eligible for inclusion to the NRHP. Eight cultural resources reports relevant to the parcel were reviewed.

TABLE 3-6

Archaeological Sites and Isolated Artifacts in the Pah Rah Parcel

Category	NRHP* Eligible	Not NRHP Eligible	Unevaluated
Prehistoric	1	0	5
Historic	0	1	0
Isolate	0	14	0

*NRHP=National Register of Historic Places

The one site on the offered (Pah Rah) parcel land was found eligible for the National Register of Historic Places based on its scientific research potential relating to issues such as upland settlement and subsistence practices. By comparison, archaeological features found on the federal land (Toquop southern parcel) have no clear function and had no associated artifacts—limiting the means to interpret them or to provide an age assessment. Similarly, sites in the federal parcel had no depth of cultural deposits that might have contained important scientific research potential.

The BLM initiated consultation with the Pyramid Lake Paiute Tribe, the Washoe Tribe of Nevada and California, and the Reno-Sparks Indian Colony regarding the Pah Rah parcel. Two tribes made trips and visual inspections without actually entering the parcel. The visit by the Washoe Tribe included a field inspection by a tribal elder that examined one of the archaeological sites and concluded it was likely a spiritual location used by a medicine person, although the age, function, and purpose are unknown. This site will be managed as an “unevaluated” cultural resource pending accumulation of additional information regarding NRHP eligibility, recent use, access, etc.

3.13 Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in assets held in trust by the federal government for Indian Tribes or individuals. The Department of the Interior Order No. 3175 requires all its bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision, and operation documents.

3.13.1 Toquop Area

According to surface land management status maps, Bureau of Indian Affairs (BIA), and BLM records, no Native American asset claims have been identified in the Toquop area.

3.13.2 Pah Rah Parcel

According to surface land management status maps and the BIA and BLM, no Native American asset claims have been identified on the Pah Rah parcel.

3.14 Environmental Justice

Title VI of the 1964 Civil Rights Act and Executive Order (E.O.) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, was signed on February 11, 1994. Federal agencies are required by

E.O. 12898 to address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The intent is that no person in the United States shall, on the basis of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

The following sections discuss the population, per capita income, and breakdown of race descriptive for the Toquop area and the Pah Rah parcel. The counties considered for the Toquop area are Clark and Lincoln; the county considered for the Pah Rah parcel is Washoe.

3.14.1 Toquop Area

Table 3-7 presents demographic data for Clark and Lincoln counties. Per capita income in Clark County was \$26,212. Per capita income in Lincoln County was \$18,448. Clark County's poverty rate was 11.1 percent. Lincoln County's poverty rate was 14.8 percent.

Lincoln County contains eight census block groups. No census block groups in Lincoln County have low-income or minority communities (BLM, 1999). No low-income or minority communities exist on, adjacent to, or in the vicinity of the Toquop area.

3.14.2 Pah Rah Parcel

Table 3-7 also presents demographic data for Washoe County. Per capita income in Washoe County was \$30,214. Washoe County's poverty rate was 9.8 percent. No low-income or minority populations exist

on or adjacent to the Pah Rah parcel. Some residents of the Pyramid Lake Indian Reservation reside less than 5 miles east of the parcel in the Wadsworth area.

3.15 Paleontological Resources

3.15.1 Toquop Area

Local geologic maps and literature were assessed for the potential of paleontological resources in the Toquop area. According to the Lincoln County geologic maps, the project areas for the Proposed Action, Alternative 1, Alternative 2, and Alternative 3 are within old alluvial gravels cemented together by calcium carbonate (Tschanz and Pampayan, 1970). The *Environmental Assessment for the Lincoln County Land Act of 2000* reported fossil-bearing strata east of the project area (also see Livingston, 2001), particularly in the Badland soil series. Badland soils occur along approximately 1.25 miles of the access road (Bagley et al., 1980). The Kern River 2003 Expansion Project reported significant fossils in Quaternary sediments and soils of the Muddy Creek Formation along the access road (Dames & Moore, 1990b and 1992). However, no paleontological resources were identified in a pedestrian survey of this area.

3.15.2 Pah Rah Parcel

Local geologic maps and literature were assessed for the potential of paleontological resources in the Pah Rah parcel. According to the Washoe County geologic maps, the Pah Rah Range consists of volcanic and non-marine sedimentary rocks. No paleontological resources are known to occur in the Pah Rah parcel.

TABLE 3-7
Demographic Data for Clark and Lincoln Counties

County	Total Population ^a	Per Capita Income ^b	Race (Percentage of Total Population) ^a
Clark County			
	1,375,765 in 1999	\$26,212 in 1997	Caucasian (71) African American (9) American Indian (1) Asian (5) Native Hawaiian (1) Other Race (13)
Lincoln County			
	4,165 in 1999	\$18,448 in 1997	Caucasian (91) African American (2) American Indian (2) Asian (1) Native Hawaiian (0) Other Race (4)
Washoe County			
	339,486 in 1999	\$30,214 in 1997	Caucasian (80) African American (2) American Indian (2) Asian (4) Native Hawaiian (1) Other Race (11)
Poverty Rate^b			
Clark County: 11.1% in 1997			
Lincoln County: 14.8% in 1997			
Washoe County: 9.8% in 1997			

Notes:

"American Indian" includes Alaska Native.

"Asian" includes Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Asian.

"Native Hawaiian" includes Native Hawaiian, Guamanian or Chamorro, Samoan, and Other Pacific Islander.

"Other Race" does not indicate the specific race.

Sources:

^a<http://factfinder.census.gov>. Bureau of the Census, 2001 (1999 data).

^b<http://www.fedstats.gov> (1997 data).

3.16 Socioeconomics

This section describes the existing social and economic conditions within Clark, Lincoln, and Washoe counties. These variables include employment, population, housing, and community infrastructure.

Clark and Lincoln counties comprise the region of influence for potential economic impacts. This two-county area was determined to be the impact region because the proposed project features would be located in Lincoln County, but the project construction and operation workforce could be expected to come from Clark and Lincoln counties. Therefore, economic effects resulting from the project would likely primarily occur in these counties. Effects could occur to other surrounding counties, or counties in other regions of the United States, depending on where project facility components are manufactured. These effects are impossible to determine. For that reason, this analysis is limited to Clark and Lincoln counties. Economic impacts on Washoe County are discussed qualitatively because no facilities are proposed for development on the Pah Rah parcel.

Because of the nature of the Proposed Action and the remoteness of the project sites, the area of influence for community infrastructure is limited to the project sites, the proposed utility alignments, and the immediately adjacent lands.

3.16.1 Toquop Area

3.16.1.1 Population

Clark County is the most populous of the 17 counties in Nevada with an estimated total population of 1,425,723 in 2000. During this year, Clark County accounted

for about 69 percent of the total state population of 2,066,831. The five incorporated cities in the county: Boulder City, Henderson, Las Vegas, Mesquite and North Las Vegas comprise almost 60 percent of the county's 2000 population. The City of Mesquite, the incorporated city in Clark County that is closest to the project site, had a population estimate at 15,605 in 2000. In 1990, the Clark County population was estimated to be 770,280 (Nevada State Demographer's Office, 2001). The total increase in population during the 10-year period from 1990 to 2000 was approximately 58 percent, with an average annual growth rate of 6.3 percent. The Nevada State Demographer's Office predicts this annual rate of growth will decrease substantially during the period of 1999 to 2010 to an average rate of 2.8 percent (Nevada State Demographer's Office, 2000). In-migration by retirees and those seeking employment in the services sector of the economy continues to be the primary influence on Clark County population growth.

Lincoln County is rural and sparsely populated. In 2000, the estimated population was 4,420 (up 16 percent from the 1990 population estimate of 3,810). This represents an average annual growth rate of 1.5 percent. The State Demographer's Office predicts this average annual growth rate will decline to 0.1 percent during the period of 1999 to 2010. Lincoln County has just one incorporated city, Caliente, with a 2000 population of 1,132. The three unincorporated towns, Alamo, Panaca and Pioche had a total 2000 population of 2,040. Combined, these three towns and the City of Caliente made up about 70 percent of the County population in 2000 (Nevada State Demographer's Office, 2000 and 2001). Out-migration of

young people seeking education and employment, and in-migration of retirees are the primary factors shaping Lincoln County population trends.

3.16.1.2 Employment

The Bureau of Economic Analysis (BEA), Regional Economic Information System (REIS) reported a Clark County employment of 815,718 for the year 1999. Table 3-8 lists Clark County employment by industry, along with percentages of total employment. The services industry

(which includes hotels, gaming, tourism entertainment, and recreation) accounts for 44 percent of the county employment. Retail trade is the next most important industry in terms of employment accounting for 16 percent of county's jobs.

Table 3-9 shows the 1999 employment estimates for Lincoln County as reported by the BEA REIS. The government and government enterprises account for 30 percent of the total county employment with retail trade accounting for another 16 percent of the total employment.

TABLE 3-8
1999 Clark County Total Full- and Part-Time Employment by Industry

	Jobs	% of Total
County Total	815,718	100.0%
Farm employment	338	<0.1%
Non-farm employment	815,380	100.0%
Ag. serv., forestry, fishing, and other	8,572	1.1%
Mining	1,467	0.2%
Construction	77,558	9.5%
Manufacturing	21,586	2.6%
Transportation and public utilities	39,924	4.9%
Wholesale trade	24,311	3.0%
Retail trade	131,648	16.1%
Finance, insurance, and real estate	72,149	8.8%
Services	362,463	44.4%
Government and government enterprises	75,702	9.3%
Federal, civilian	8,607	1.1%
Military	9,068	1.1%
State and local	58,027	7.1%
State	11,578	1.4%
Local	46,449	5.7%

Source: BEA REIS, 2002

TABLE 3-9
1999 Lincoln County Total Full- and Part-Time Employment by Industry

	Jobs	% of Total
County Total	2,000	100.0%
Farm employment	149	7.5%
Non-farm employment	1,851¹	92.5%
Ag. serv., forestry, fishing, and other	D	
Mining	37	1.9%
Construction	44	2.2%
Manufacturing	D	
Transportation and public utilities	62	3.1%
Wholesale trade	D	
Retail trade	319	16.0%
Finance, insurance, and real estate	92	4.6%
Services	D	
Government and government enterprises	607 ¹	30.4%
Federal, civilian	35	1.8%
Military	L	
State and local	564	28.2%
State	155	7.8%
Local	409	20.5%

Source: BEA REIS, 2002

D = Estimate not shown to avoid disclosure of confidential information; estimate included in non-farm total

L = Estimate less than \$50,000 or less than 10 jobs; estimate included in non-farm total

¹ Totals for categories are greater than the sum of the individual items because of data not provided for confidentiality reasons. However, as stated above for "D," the non-farm total includes the confidential number which accounts for the discrepancies in numbers presented. This is also the case for the government category.

3.16.1.3 Unemployment

Between 1990 and 2001, the average annual unemployment rate in Clark County has ranged from a high of 7.1 percent in 1993 to a low of 4.0 percent in 1997. In 2001, the average annual unemployment rate was 5.5 percent. In general, the Clark County unemployment rate for the period of 1990 to 2001 has been slightly lower than the state averages,

which had a range of 4.1 percent in 1997 and a high of 7.2 in 1993 (Nevada Department of Employment, Training and Rehabilitation, 2002).

For Lincoln County, the unemployment rate is generally higher than the state average. During the period between 1990 and 2001, Lincoln County had a maximum unemployment rate of 11.9 percent in 1995 and a low of 6.1 percent in 1999. In

2001, the average annual unemployment rate was 7.2 percent (Nevada Department of Employment, Training and Rehabilitation, 2002).

3.16.1.4 Earnings and Income

Per capita income in Clark County in 1989 was \$15,109 (Bureau of the Census, 1991); in 1997, it was \$26,212. Total personal income in Clark County in 1997 was \$29,013,523,000 (FedStats, 2001). Table 3-10 shows the place of work earnings by industry for the year 1999 as reported by the BEA REIS. The services industry accounts for 42 percent of the county earnings, followed by government

and government services with about 13 percent, and the construction industry with about 12 percent of the place of work earnings.

Per capita income in Lincoln County in 1989 was \$9,074 (Bureau of the Census, 1991); in 1997, it was \$18,448. Total personal income in Lincoln County in 1997 was \$76,227,000 (FedStats, 2001).

Table 3-11 shows the Lincoln County place of work earnings by industry for the year 1999 as reported by the BEA REIS. The government and government services industry accounts for almost 40 percent of the County earnings.

TABLE 3-10
1999 Clark County Place of Work Earnings by Industry

	Place of Work Earnings (\$1,000)	% of Total
County Total	28,047,163	100.0%
Farm Earnings	7,841	0.0%
Non-farm Earnings	28,039,322	100.0%
Ag. Serv., forestry, fishing, and other	193,404	0.7%
Mining	40,005	0.1%
Construction	3,347,301	11.9%
Manufacturing	826,733	2.9%
Transportation and public utilities	1,592,680	5.7%
Wholesale trade	1,034,457	3.7%
Retail trade	2,778,812	9.9%
Finance, insurance, and real estate	2,707,802	9.7%
Services	11,902,591	42.4%
Government and government enterprises	3,615,537	12.9%
Federal, civilian	552,532	2.0%
Military	367,317	1.3%

TABLE 3-10
1999 Clark County Place of Work Earnings by Industry

	Place of Work Earnings (\$1,000)	% of Total
State and local	2,695,688	9.6%
State	475,180	1.7%
Local	2,220,508	7.9%

Source: BEA REIS, 2002

TABLE 3-11
1999 Lincoln County Place of Work Earnings by Industry

	Place of Work Earnings (\$1,000)	% of Total
County Total	58,616	100.0%
Farm Earnings	564	1.0%
Non-farm Earnings	58,052¹	99.0%
Ag. serv., forestry, fishing, and other	D	
Mining	938	1.6%
Construction	858	1.5%
Manufacturing	D	
Transportation and public utilities	3,138	5.4%
Wholesale trade	D	
Retail trade	3,649	6.2%
Finance, insurance, and real estate	1,210	2.1%
Services	D	
Government and government enterprises	22,974	39.2%
Federal, civilian	1,809	3.1%
Military	112	0.2%
State and local	21,053	35.9%
State	7,896	13.5%
Local	13,157	22.4%

Source: BEA REIS, 2002

D = Estimate not shown to avoid disclosure of confidential information; estimate included in non-farm total

¹ Totals for categories are greater than the sum of the individual items because of data not provided for confidentiality reasons. However, as stated above for "D," the non-farm total includes the confidential number which accounts for the discrepancies in numbers presented.

3.16.1.5 Tax Receipts

Clark County's fiscal year (FY) 1999-2000 taxable sales were \$21.2 billion. Based on a sales and use tax rate of 7.25 percent, the estimated sales tax generated in FY 1999-2000 was \$1.5 billion (Nevada Department of Taxation, 2001). The total assessed value of property in the county (35 percent of the taxable value) for FY 1999-2000 was \$30.5 billion. Projected property tax revenue for the county was \$906.2 million, resulting in an average property tax rate of 2.967 percent (Nevada Department of Taxation, 1999).

Lincoln County's FY 1999-2000 taxable sales were \$25.2 million. Based on a sales and use tax rate of 6.75 percent, the estimated sales tax generated in FY 1999-2000 was \$1.7 million (Nevada Department of Taxation, 2001). The total assessed value of Lincoln County properties was \$82.6 million in FY 1999-2000. Projected property tax revenue for the county was \$2.3 million, resulting in an average property tax rate of 2.832 percent (Nevada Department of Taxation, 1999).

3.16.1.6 Housing

The 2000 Census reports that the total number of housing units in Clark County was 559,799. Of this total, 512,253 units were occupied, with a corresponding vacancy rate of 8.5 percent. The percentage of owner-occupied units was 59.1; the percentage of renter-occupied units was 40.9. The average household size was 2.65 persons (Bureau of the Census, 2001).

The 2000 Census reports that the total number of housing units in Lincoln County was 2,178. Of this total, 1,540 units were occupied, with a

corresponding vacancy rate of 29.3 percent. The percentage of owner-occupied units was 75.1; the percentage of renter-occupied units was 24.9. The average household size was 2.48 persons (Bureau of the Census, 2001).

The nearest residential communities are the cities of Mesquite in Clark County, approximately 12 miles from the southern Toquop site, and Caliente in Lincoln County. This is the only incorporated city in Lincoln County and is approximately 50 miles north of the southern Toquop site—although driving distance to Caliente from the project site is approximately 170 miles.

3.16.1.7 Community Infrastructure

3.16.1.7.1 Education. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. No schools are located in the project area. The nearest schools are in Mesquite.

3.16.1.7.2 Police Protection. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. No police protection facilities are located in the project area. BLM enforcement has one officer assigned to this area.

The Lincoln County Sheriff's Department provides law enforcement services to Lincoln County, including the Toquop area. The department has 16 personnel, 10 of which are patrol deputies. Two sheriff stations, one in Alamo and the other in Pioche, are located in the county. The response time to the Toquop area from the Pioche station is approximately 2 hours (Bradfield, 2001). The nearest law

enforcement center is Mesquite in Clark County.

3.16.1.7.3 Fire Protection. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. No fire protection facilities are located in the project area.

The nearest fire station to the Toquop area is in Mesquite. Lincoln County has four fire fighting stations, each with an engine and ambulance. The stations are located in Alamo, Caliente, Panaca, and Pioche. All four stations are manned by volunteer firefighters. The dispatch for the four stations is handled through the sheriff's department in Pioche. The Lincoln County station nearest the Toquop area is in Alamo, and the response time to the area is approximately 2 hours (Bradfield, 2001). BLM has a fire fighting station in Caliente and an agreement with the Las Vegas BLM office that would allow the fire station in Mesquite to respond to wildfires in southern Lincoln County. The Mesquite station would have an approximate 30-minute response time, utilizing Type 3 engines.

3.16.1.7.4 Hospitals and Medical Care. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. No medical facilities are located in the project area. The 137-bed Dixie Regional Medical Center is in St. George, Utah, approximately 35 miles east of Mesquite. The Grover C. Dils Hospital, a 20-bed facility owned by Lincoln County, is in Caliente approximately 50 miles north of the southern Toquop site—although driving distance to Caliente from the project site is approximately 170 miles.

3.16.1.7.5 Water and Wastewater. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. No municipal or industrial water or wastewater facilities are located in the project area.

3.16.1.7.6 Natural Gas. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. The 36-inch Kern River Gas Pipeline crosses the southeast corner of the southern Toquop parcel.

3.16.1.7.7 Telephone. The southern Toquop parcel, northern Toquop parcel, wellfield, and associated utility alignment corridors are undeveloped lands. The Touch America, Inc. (Williams Communications) fiber optic communication cable crosses the southeast corner of the southern Toquop parcel along the southeast side of the natural gas line. No telephone facilities are located in the project area. The Toquop area is in the service area of Lincoln County Telephone.

3.16.1.7.8 Electricity. The northern Toquop parcel is undeveloped. Three overhead electric transmission lines cross the southern Toquop parcel. Easements are granted for one transmission line to the Bureau of Reclamation, City of Los Angeles, and Nevada Power Company. A second transmission line is owned by the Intermountain Power Project. The third transmission line is owned by Nevada Power Company (Resource Concepts, Inc., 2001a). The Toquop area is in the service area of the Lincoln County Power District.

3.16.2 Pah Rah Parcel

3.16.2.1 Population

Although Southern Washoe County contains the urbanized Reno Metropolitan Statistical Area (MSA), the majority of the county's land area is sparsely settled and rural in character. The County is the second most populated (behind Clark County) with a 2000 population estimate of 333,566. This represents nearly a 30 percent increase from the 1990 population of 257,120, resulting in an annual average growth rate of 2.6 percent. The State Demographer's office predicts the county's growth rate will slow to

1.7 percent per year for the period between 1999 and 2010. The incorporated cities of Reno and Sparks account for almost 75 percent of the county population.

3.16.2.2 Employment

The BEA REIS reported a Washoe County employment of 231,950 for the year 1999. Table 3-12 lists Washoe County employment by industry along with percentages of total employment. The services industry (which includes hotels, gaming, tourism entertainment, and recreation) accounts for 40 percent of the county employment. Retail trade is the next most important industry in terms of employment accounting for 15 percent of the county jobs.

TABLE 3-12
1999 Washoe County Employment by Industry

	Total Full- and Part-Time Employment (jobs)	% of Total
County Total	231,950	100.0%
Farm employment	686	0.3%
Non-farm employment	231,264	99.7%
Ag. serv., forestry, fishing, and other	2,000	0.9%
Mining	891	0.4%
Construction	17,063	7.4%
Manufacturing	14,151	6.1%
Transportation and public utilities	13,290	5.7%
Wholesale trade	12,888	5.6%
Retail trade	35,903	15.5%
Finance, insurance, and real estate	21,314	9.2%
Services	91,385	39.4%
Government and government enterprises	22,379	9.6%
Federal, civilian	3,156	1.4%
Military	676	0.3%
State and local	18,547	8.0%
State	6,053	2.6%
Local	12,494	5.4%

Source: BEA REIS, 2002

3.16.2.3 Unemployment

Between 1990 and 2001, the average annual unemployment rate in the Reno MSA (Washoe County) has ranged from a high of 6.5 percent in 1993 to a low of 3.0 percent in 2000. In 2001, the average annual unemployment rate was 5.5 percent. In general, the Reno MSA unemployment rate for this period has been about 0.5 percent lower than the State average, which had a range of 4.1 percent in 1997 and a high of 7.2 percent in 1993 (Nevada Department of Employment, Training and Rehabilitation, 2002).

The annual average unemployment rate in Washoe County in 1991 was 5.0 percent; in 2000, it was 3.0 percent. In 2001, the average rate through August was

3.9 percent (Bureau of Labor Statistics, 2001).

3.16.2.4 Earnings and Income

Per capita income in Washoe County in 1989 was \$16,365 (Bureau of the Census, 1991); in 1997, it was \$30,214. Total personal income in Washoe County in 1997 was \$9,261,636,000 (FedStats, 2001). Table 3-13 shows the place of work earnings by industry for the year 1999 as reported by the BEA REIS. The services industry accounts for 36 percent of the county earnings, followed by government and government services with about 14 percent, and retail trade with about 10 percent of the total county place of work earnings.

TABLE 3-13
1999 Washoe County Place of Work Earning by Industry

	Place of Work Earnings (\$1,000)	% of Total
County Total	7,852,487	100.0%
Farm employment	2,582	0.0%
Non-farm employment	7,849,905	100.0%
Ag. serv., forestry, fishing, and other	40,568	0.5%
Mining	49,710	0.6%
Construction	734,145	9.3%
Manufacturing	605,655	7.7%
Transportation and public utilities	585,288	7.5%
Wholesale trade	547,560	7.0%
Retail trade	766,609	9.8%
Finance, insurance, and real estate	593,710	7.6%
Services	2,821,548	35.9%
Government and government enterprises	1,105,112	14.1%
Federal, civilian	206,104	2.6%
Military	10,574	0.1%
State and local	888,434	11.3%
State	338,796	4.3%
Local	549,638	7.0%

Source: BEA REIS, 2002

3.16.2.5 Tax Receipts

Washoe County's budget is \$455 million, of which approximately 50 percent is referred to as the general fund. Almost 80 percent of the general fund is from sales tax (41 percent) and property tax (38 percent) revenues (Washoe County, 2001).

3.16.2.6 Housing

The 2000 Census indicates that the total number of housing units in Washoe County was 143,908. Of this total, 132,084 units were occupied, with a corresponding vacancy rate of 8.2 percent. The percentage of owner-occupied units was 59.3; the percentage of renter-occupied units was 40.7. The average household size was 2.53 persons (Bureau of the Census, 2001).

3.16.2.7 Community Infrastructure

The Pah Rah parcel is undeveloped land. There are no schools, police protection facilities, medical facilities, water or wastewater facilities, natural gas facilities, telephone facilities, electricity generation, or transmission facilities on the project site. Two overhead 345-kV electric transmission lines are located north of the Pah Rah parcel. An overhead 60-kV electric transmission line and a gas transmission pipeline are located south of the parcel.

3.17 Transportation

This section discusses existing roadways in the Toquop area and Pah Rah parcel.

3.17.1 Toquop Area

Interstate 15 (I-15) is the only major roadway in the vicinity of the southern Toquop parcel. It is the main north-south route connecting Las Vegas, Nevada, and Salt Lake City, Utah. I-15 is approximately 11 miles south of the southern parcel. In this area, the interstate freeway is aligned southwest-northeast. Access to both the southern and northern Toquop parcels is from I-15 via the East Mesa Interchange (Exit 109) approximately 9 miles west of Mesquite, Nevada. Exit 109 is a truck rest area—a paved area without facilities that can be accessed directly from eastbound and westbound I-15.

The existing freeway exit leaves westbound I-15 directly on the north side and travels west for approximately 0.6 mile parallel to I-15 on a lightly paved two-lane road. The exit from eastbound I-15 doubles back to the west for approximately 0.6 mile parallel to and south of I-15 on another lightly paved two-lane road. The latter road then crosses under I-15 at 90 degrees through two single-lane concrete underpasses where it intersects the former road and continues west parallel to I-15 for another 0.5 mile on the north side of the freeway. The distance to the southern Toquop parcel from I-15 is 14.4 miles. The northern plant site is approximately 12 miles farther along the same road.

The access road from I-15 to the northern power plant site is in good condition except for the 8 miles between a turn-off that leads to communications towers and northern side of Toquop Wash. The section from the towers through the Toquop Wash is two-track, has many sharp turns, and requires slow speeds.

The roadway characteristics of I-15 in the vicinity of the two Toquop parcels consist of a paved divided freeway with paved shoulders, two lanes in each direction, a “good” roadway condition, and a posted speed limit of 75 mph.

Table 3-14 lists the existing and projected (year 2003) average daily traffic volume for I-15 near the East Mesa Interchange (Exit 109) and for the East Mesa Interchange offramp.

3.17.2 Pah Rah Parcel

Interstate 80 (I-80) is the major roadway in the vicinity of the Pah Rah parcel. It is an east-west route and is approximately 1.25 miles south of the parcel. The roadway characteristics of I-80 in the vicinity of the Pah Rah parcel consist of a paved divided freeway with paved shoulders, two lanes in each direction, a

“good” roadway condition, and a posted speed limit of 70 mph.

Access to the Pah Rah parcel can occur from two locations. From the south, exit I-80 at the Derby Dam exit (Exit 36); on the north side of the freeway is an unpaved pull-out area. The parcel is approximately 1.5 miles northeast of this location. The site can be accessed on foot and is a steep climb.

Access to the Pah Rah parcel from the north is accomplished by exiting at either of two exits from I-80 at State Route (S.R.) 447 on either side of Wadsworth, Nevada. S.R. 447 is a northwest-southeast trending two-lane paved road after passing through Wadsworth. Turn west onto Olinghouse Road from S.R. 447 at approximately 3.8 miles north of I-80. Travel west approximately 4.3 miles along the graded Olinghouse Road to the

TABLE 3-14
Existing and Estimated Average Daily Traffic Volumes on I-15 near the Project Area

Roadway	Average Daily Vehicle Traffic (ADT)	Average Daily Truck Traffic (ADTT) ^b
I-15 near the East Mesa Interchange (2000)	15,800 ^a	1,580
Eastbound	7,900 ^a	790
Westbound	7,900 ^a	790
I-15 near the East Mesa Interchange (2003 estimated)	18,818 ^c	1,882
Eastbound	9,409 ^c	941
Westbound	9,409 ^c	941
East Mesa Interchange offramp (2000)	680 ^a	68
Eastbound	280 ^a	28
Westbound	400 ^a	40
East Mesa Interchange offramp (2003 estimated)	810 ^c	81
Eastbound	330 ^c	33
Westbound	480 ^c	48

^a Source: Leegard (2001).

^b Estimated at 10 percent of ADT.

^c Calculated at 6 percent annual growth rate, based on historical traffic records.

transmission line road. Turn south on an ungraded road, cross an ephemeral creek, and keep right at 0.3 mile, proceeding southeast along the transmission line

access road for an additional 1.6 miles. The site can be accessed on foot, and, depending on location, can be a steep climb.